Preface

This is the first in a planned series of books on English composition for the natural sciences. These books are intended specifically as a reference for Japanese researchers, but hopefully they will be found useful by a wider audience.

In writing these books, it is not my purpose to create a comprehensive guide to scientific writing. Even if something of such a general nature could be written, it would be of little practical use. It is also not my intention to explain standard points of English grammar or elementary rules of English composition, as there are already many textbooks on these subjects. Rather, my goal is to create a practical tutorial that addresses specific common mistakes made by Japanese scholars and to thus help them improve their writing by eliminating these mistakes one by one.

Over the past nine years, I have proofread close to 2,000 papers, most written by professional mathematicians, physicists and engineers. During this time, I have found that many of the mistakes I see are repeated again and again. The pervasiveness of some indicates almost universal misunderstandings. Such mistakes are the focus of these books, and my aim is to treat them by identifying and remedying the misunderstandings from which they result.

With this aim, the topics covered in these books were chosen through the following empirical process. While proofreading scholarly papers, I first identified the types of mistakes that appear most often. Then, I selected from those only the mistakes that create problems sufficiently serious to warrant consideration. With the scope thereby focused, I identified the cause of each mistake and categorized them accordingly. The resulting categories form the individual topics treated in this series. The breadth of the selected topics covers most of the significant problems that I encounter in proofreading the works of Japanese researchers. Although any number of additional topics could be added, I believe that those I have chosen treat the most common and most serious misunderstandings.

Each topic is addressed in a problem-oriented manner, with specific mistakes demonstrated by sample sentences taken from actual papers (and appropriately altered to clearly illuminate the problem under consideration). The examples consisting of these original sentences and their corrected versions form the backbone of each chapter, with the accompanying discussion focused on their elucidation. Although, as dictated by necessity, this discussion at times does become somewhat complicated and occasionally involves subtleties inherent in the English language and in the expression of ideas in science and mathematics, its purpose is always practical: to first identify the causes of and demonstrate the problems resulting from specific mistakes, and then to explain the use of alternative expressions and constructions allowing for their elimination.

The ultimate goal for students of a foreign language should be the development of an intuitive understanding. Without such an understanding, writing remains a mechanical operation that can never do justice to the ideas it is intended to convey. According to my personal experience, such an understanding can only be gained by studying many concrete examples. I hope that through contemplation of the examples presented here, readers will eventually develop an insight that transcends the set of 'microscopic' lessons they provide.

I now give some discussion concerning the presentation and interpretation of example sentences.

Throughout the book, example sentences demonstrating problematic writing are numbered with red numerals, and those demonstrating proper writing are numbered with black numerals. In most cases, an example containing some mistake appears first, with one or more corrected versions appearing below. Corrected versions of a given problematic example are always labeled by the same number as the original. When there are multiple corrected versions, they are denoted (1), (1^*), (1^{**}), etc. In almost every case, there are many possible ways to rewrite the original sentence. The judgment I make in selecting a particular corrected form obviously reflects my personal preferences regarding style, and the rewritten versions I choose certainly do not represent all possibilities. (Constructing additional alternatives would be a good exercise for the reader.) When rewriting these sentences, I usually place highest priority on expressing the meaning intended by the author of the original. Often, however, in the interest of clarity, improved style or more appropriate reasoning, it is necessary to choose wordings that express slightly different or, in some cases, significantly different meanings. In addition, in many cases the intended meaning of the original is unclear. In such situations, I attempt to offer rewritten versions expressing each of its possible interpretations.

In some sentences I use the notation "/···/···/" to present multiple alternative expressions, as in the following.

> This sudden drop in pressure /is due to/is caused by/results from/ the change in volume.

The implication here is that the expressions "is due to," "is caused by" and "results from" are all possible. In general, the meanings imparted by the various expressions presented in this manner will differ to some extent, and in some cases these differences are substantial.

The titles of the volumes in this series, *English Composition for Scholarly Works*, are tentatively planned as follows:

> Volume 1: *Commonly Misused Words and Expressions*
> Volume 2: *Articles, Prepositions and Pronouns*
> Volume 3: *Verbs*
> Volume 4: *Grammar, Structure and Style*
> Volume 5: *Special Problems in Mathematics and Physics*

In the present volume, I treat words and expressions that I have found to be particularly troubling for Japanese authors. For the most part, I have excluded problems peculiar to the use of articles, prepositions, pronouns and verbs from this volume, because these are sufficiently numerous and complicated to necessitate separate consideration. In most cases, I treat one word or expression per chapter. Each chapter is entirely self-contained, although there are references made among chapters to connect related material.

Contents

Chapter 1

abbreviate

1.1 Misused as a synonym of *omit*

The verb *abbreviate* should not be used to mean *omit*. The difference between these words is demonstrated by the following.

> (1) In the remainder of the paper, we abbreviate H^α by omitting the superscript α.

As seen from this example, *abbreviate* is not synonymous with *omit* or *delete*, but rather with *shorten* or *simplify*.

The sentences below exemplify the most common misuse of *abbreviate*.[1]

> (2) We abbreviate the subscripts here, since the meaning of each variable is clear without them.
> (2) We /omit/do not include/have deleted/ the subscripts here, since the meaning of each variable is clear without them.
> (3) From this point, we abbreviate the argument x in $\psi(x, k)$ as $\psi(k)$.
> (3) From this point, we /omit/suppress/ the argument x of ψ, writing it simply as $\psi(k)$.
> (4) In this expression, the color indices r, g and b are abbreviated.
> (4) In this expression, the color indices r, g and b are omitted.

The main clause of (2) ("we abbreviate...here") implies that the subscripts in question appear in some shortened form. However, from the second clause, it is clear that the intended meaning is expressed by *omit*. The awkwardness of (3) is perhaps a more serious problem than its misuse of "abbreviate." The rewritten form above represents one option, but the author's intention can perhaps be most concisely expressed as follows.

> (3*) From this point, we abbreviate $\psi(x, k)$ as $\psi(k)$.

[1] These examples demonstrate that the meaning of *abbreviate* is narrower than that of 省略する .

1.2 Misused as a synonym of *represent*

The problem exemplified by the following, although not as common as that treated in the previous section, warrants consideration.

> (1) In (3.3), n abbreviates the quantum numbers of the quark.
> (1) In (3.3), n represents the quantum numbers of the quark.
> (1*) In (3.3), n represents the quantum numbers of the quark in abbreviated form.

In the original, that which is in abbreviated form, "n," inappropriately acts as the subject of the verb "abbreviates." The resulting assertion does not make sense.

1.3 Misuse with *by* and *to*

The following demonstrate common mistakes.

> (1) We abbreviate $S(\eta, i)$ by S_i.
> (1) We abbreviate $S(\eta, i)$ as S_i.
> (2) In the above, the expression given in Eq. (4.2) is abbreviated by $\mathbf{A} \cdot \mathbf{C}$.
> (2) In the above, the expression given in Eq. (4.2) is abbreviated $\mathbf{A} \cdot \mathbf{C}$.
> (3) Here, the distribution function is abbreviated to $\sigma(x)$.
> (3) Here, the distribution function is abbreviated as $\sigma(x)$.
> (3*) Here, the distribution function is written simply as $\sigma(x)$.

In the above, the prepositions "by" and "to" are misused to introduce the abbreviated forms in question. In (1) and (3), this problem is solved by replacing the incorrect preposition by the correct one, "as," while in (2) it is solved by simply removing "by." In (1) and (3), "S_i" and "$\sigma(x)$" are the objects of "as," and in (2), "$\mathbf{A} \cdot \mathbf{C}$" acts as the complement of the (passive) verb "is abbreviated."[2]

[2]Note that the problems in (1) and (2) are in some sense related to those considered in Section 1 of Chapter 29.

Chapter 2

about

2.1 Misused to mean *approximately*

It is usually better to use *approximately* instead of *about* when making a quantitative comparison or making a statement about a quantitative value. The main reason for this is that *about* has many meanings, and therefore its usage can result in somewhat imprecise statements. The following demonstrate problems of this kind.

(1) These values are all about 2.0.
(1) These values are all approximately equal to 2.0.
(2) These cross sections are all about the same.
(2) These cross sections are all approximately equal.
(3) The probability of observing a single hyperfragment is about 4–6% in the momentum region $600 \leq p_{K^+} \leq 900$ MeV/c.
(3) The probability of observing a single hyperfragment is approximately 4–6% in the momentum region $600 \leq p_{K^+} \leq 900$ MeV/c.
(4) The invariant mass resolution was found to be about 4 MeV/c^2 below 1.26 GeV/c^2.
(4) The invariant mass resolution was found to be approximately 4 MeV/c^2 in the region below 1.26 GeV/c^2.
(5) When the films are thinner than about 100 nm, a reduction of T_g can be observed.
(5) Below a thickness of approximately 100 nm, a decrease of T_g can be observed.

The original sentences here are, to varying degrees, ambiguous. The rewritten version of each expresses the most natural interpretation. The other possible interpretations are as follows. Example (1) could be understood as meaning that “these values” are distributed on either side of 2.0. (If, in fact, this were the intended meaning, it would be best to change “about” to *scattered about* or *distributed about*.) This does not necessarily imply that they are approximately equal to 2.0. Another possible (albeit somewhat unusual) interpretation of the original is that “these values” are somehow in reference to or in regard to 2.0. Example (2) could be interpreted as a statement about, for example, the qualitative nature of these cross sections or

the mathematical forms in which they are expressed. It is possible to interpret (3) as meaning that this probability is somewhere on one or the other side of the range 4–6%, but not in this range. Example (4) could be understood as describing a set of values for the mass resolution that are distributed on either side of 4 MeV. It is more likely, however, that the intended meaning is with regard to a single value, as expressed by (4). The final example is somewhat different from the first four. Here, the ambiguity of the original would not be eliminated by simply replacing "about" with *approximately*. (Also note that "decrease" is better than "reduction" here.)

2.2 Misused in statements specifying a topic, context, focus or scope

Uses of *about* illustrated by the following are best avoided in scholarly writing.

(1) Their paper is about the dynamics of phase separation in homopolymer systems.
(1) Their paper /investigates/studies/treats/concerns/ the dynamics of phase separation in homopolymer systems under shear.
(2) This equation is only about the behavior for $\tau > \tau_0$.
(2) This equation only /regards/describes/ the behavior for $\tau > \tau_0$.
(3) Alexander's book is the most authoritative work about the mathematical aspects of these systems.
(3) Alexander's book is the most authoritative work /on/concerning/regarding/dealing with/treating/ the mathematical aspects of these systems.
(4) However, this conclusion is only about the former case.
(4) However, this conclusion /regards/relates to/concerns/applies to/is relevant to/ only the former case.
(5) The following discussion is about the non-linear case.
(5) The following discussion /is relevant to/regards/concerns/is in reference to/ the non-linear case.
(6) The approximation about the binding energy is too poor to allow for useful predictions in this case.
(6) The approximation /of/with regard to/ the binding energy is too poor to allow for useful predictions in this case.
(7) About the lower branch solution, we now discuss the type of calculational procedure employed in this paper.
(7) /In reference to/With regard to/Considering/ the lower branch solution, we now discuss the type of calculational procedure employed in this paper.
(8) The relation between these local dynamics and large-scale structure formation is not yet clear, especially about the formation of crystalline structure.
(8) The relation between these local dynamics and large-scale structure formation is not yet clear, especially with regard to the formation of crystalline structure.
(9) Experimental results about this system are almost non-existent.

(9) Experimental results /regarding/concerning/relating to/for/ this system are almost non-existent.
(10) The so-called 'L-L conjecture' about this class of polynomials is proved to be incorrect.
(10) The so-called 'L-L conjecture' /concerning/regarding/with respect to/ this class of polynomials is proved to be incorrect.
(11) One difference between these procedures is about the treatment of explicitly time-dependent terms.
(11) One difference between these procedures /involves/regards/concerns/is in/ the treatment of explicitly time-dependent terms.

The use of "about" in each of these sentences expresses the meaning that some thing A provides some information about some thing B, which represents a topic, context, scope, etc. (In most cases we have one of the structures *A is about B* or *A about B*.) These uses of "about" are problematic because (except in the special situation discussed in Section 4) they imply that, in some sense, A tells a 'story' about B. In all the original sentences above, this connotation is inappropriate. In informal written and spoken English, the use of *about* demonstrated above is not uncommon, but in written scholarly work, it leads to both inaccurate assertions and inappropriate informality. The meaning conveyed by "about" in the above examples is that A provides information in an informal, non-systematic manner. This contrasts sharply with the meanings conveyed by *deals with*, *treats*, *investigates* and *studies*. Because *about* creates an air of informality, expressions like those used in the above examples are normally appropriate only when B is something that (within the present context) is not being regarded as a subject of scholarly investigation, as demonstrated by the following.

(12) The movie is about a professional baseball team in the 1890s.
(13) I wrote a story about my hometown.

These uses of "about" are appropriate, because in each case, the expression playing the role of A can be considered a kind of story.

2.3 The expression *care about*

In general, the expression *care about* is not appropriate for use in scholarly writing. This is particularly true in the case of scientific works.

(1) We do not care about terms smaller than $O(\epsilon^2)$ in this calculation.
(1) We ignore terms smaller than $O(\epsilon^2)$ in this calculation.
(1*) Terms smaller than $O(\epsilon^2)$ are irrelevant in this calculation.
(2) We do not care about such complicated systems in this study.
(2) We do not consider such complicated systems in this study.
(2*) Such complicated systems are beyond the scope of this study.

2.4 Appropriate use with *information* and related words

As discussed in Section 2, generally, when *about* is used in an expression with the meaning that some thing A provides information about some thing B, the implication is that, in some sense, this is done in the form of a story. An exception to this rule is demonstrated by the following.

> (1) These experiments provide information about the long-range interaction.
> (2) However, details about the formation process have not been sorted out.
> (3) Knowledge about this class of phenomena is increasing rapidly.

As illustrated by these sentences, when A in an expression like *A is about B* represents something that can be regarded as a form of information, there is no implication that A tells a story. In the above, the role of A is played by "information," "details" and "knowledge."

Chapter 3

according to

The preposition *according to* is commonly misused in many ways. In the papers that I proofread, its incorrect use appears at least as often as its correct use.

3.1 Proper use

To better understand the improper use of *according to*, it is helpful to first consider its proper use. This expression can be used in three ways: to mean *in keeping with* or *in agreement with*, to mean *as stated by* or *on the authority of*, and to mean *in the manner determined by*. These three uses are demonstrated by the following.

in keeping with **or** *in agreement with*

> (1) As we see from the figure, the experimental form $\mathcal{S}(x,t)$ behaves according to the present theory in regions I and III.
> (2) We employ the non-relativistic Schrödinger optical potential with the above G matrix according to the procedure of Richards.
> (3) It is seen that until a time $t^* \propto \gamma^{-1}\tau$, the bacterial population grows according to a simple exponential growth law.

as stated by **or** *on the authority of*

> (4) According to this prediction, in an off-critical quench, the b.c.c. phase appears before the triangular phase.
> (5) According to Aoyagi, the latter method is more effective in the treatment of systems in the large γ regime.

in the manner determined by

> (6) In this model, the output of each neuron changes continuously and simultaneously according to (1.1)–(1.3).
> (7) Here, the symmetry of $U(t)$ changes with those of $m(t)$ and $\sigma(t)$ according to the definition (4.4).
> (8) The model of Goodwin and Cohen suggests that it is difficult to organize the morphogen gradient according to the polarity.

Grammatically, in each of the above sentences, the prepositional phrase introduced by "according to" acts as an adverb, modifying a verb.[1] These verbs are the following: "behaves," "employ," "grows," "appears," "is," "changes," "changes," and "organize."

3.2 Improper use

There are many ways in which *according to* is used improperly.[2] In most such instances, the intended meaning is somewhat close to one of the meanings stated in the previous section, but this closeness does not diminish the seriousness of the problem this misuse creates. Below I give a number of examples illustrating the most common misuses of this expression. In order to understand why these uses are inappropriate, it is often necessary to consider closely what the intended meaning is and how this is misrepresented by "according to."

(1) According to the entropic effect, the polymer tends to occupy a large spatial region.
(1) /Owing to/As a result of/ the entropic effect, the polymer tends to occupy a large spatial region.
(2) According to the primitive method of obtaining these curves, they contain some unnatural parts.
(2) Because the method of obtaining these curves is quite primitive, they contain some unnatural parts.
(2*) /Due to/Because of/ the primitive nature of the method for obtaining these curves, they contain some unnatural parts.
(3) According to the fact that P^1 is a circle, the calculation is greatly simplified.
(3) Because P^1 is a circle, the calculation is greatly simplified.
(3*) The calculation is greatly simplified by the fact that P^1 is a circle.
(4) According to the fourth-order calculation, the critical storage capacity is approximately 0.046.
(4) Calculated to fourth order, the critical storage capacity is found to be approximately 0.046.
(5) The cross section increases according to the increase of the coupling constant as shown by the dashed curves.
(5) The cross section increases as a function of the coupling constant in the manner described by the dashed curves.
(6) We next investigate the change of the feasible region of (C, K, CO) according to the change of the input correlation time scale.
(6) We next investigate the dependence of the feasible region of (C, K, CO)

[1] Prepositional phrases often act as adverbs. A phrase that acts as an adverb is called an 'adverbial'.

[2] It seems that in most cases, the types of problems considered here result from the inappropriate use of *according to*... to express the meaning of ... によって or ... によれば (and in the remaining cases, apparently, ... に従って). While there are many situations in which *according to* does correspond to one of these, there are many more in which it does not.

on the input correlation time scale.
(6*) We next investigate the manner in which the feasible region of (C, K, CO) depends on the input correlation time scale.
(7) According to the Madison convention, we use the latter form.
(7) Following the Madison convention, we use the latter form.
(8) We fill the valence particles from the z axis to $\mu = \cos\theta$, according to Jones.
(8) We fill the valence particles from the z axis to $\mu = \cos\theta$, following Jones.
(9) According to Smith and Petrovic, we first integrate over y, obtaining a form suited to our purposes.
(9) Following Smith and Petrovic, we first integrate over y, obtaining a form suited to our purposes.
(9*) Using the method of Smith and Petrovic, we first integrate over y, obtaining a form suited to our purposes.
(10) According to our knowledge from physiological studies, activity levels of real neural systems are believed to be low.
(10) From the results of physiological studies, activity levels of real neural systems are believed to be low.
(10*) Physiological studies indicate that the activity levels of real neural systems are low.
(11) According to the close similarity of the graphs in Figs. 2 and 3, we can conclude that the single-mode approximation is sufficient.
(11) /Noting/From/ the close similarity of the graphs in Figs. 2 and 3, we can conclude that the single-mode approximation is sufficient.
(12) According to Ref. [21], we regard the diffusion term as a perturbation.
(12) /As in/Following/ Ref. [21], we regard the diffusion term as a perturbation.
(13) According to our method this term is treated as a perturbation.
(13) In our method, this term is treated as a perturbation.
(13*) According to the assumptions of our method, this term is treated as a perturbation.
(14) In contrast, the coexistence of the two groups is restored even under disturbances according to our scenario.
(14) In contrast, the coexistence of the two groups is restored even under disturbances in our scenario.
(14*) In contrast, according to the results derived in our scenario, the coexistence of the two groups is restored even under disturbances.
(15) There are two solutions to Eq. (3), according to the two values of τ.
(15) There are two solutions to Eq. (3), corresponding to the two values of τ.
(15*) There are two solutions to Eq. (3), one for each value of τ.
(16) There are several conclusions that can be drawn from this result, according to the interpretation of the drift.
(16) There are several conclusions that can be drawn from this result,

each corresponding to a different interpretation of the drift.
(16*) There are several conclusions that can be drawn from this result, because there are several possible interpretations of the drift.
(17) According to this prescription, we can construct closed-form solutions.
(17) /Following/With/Employing/Applying/ this prescription, we can construct closed-form solutions.
(18) There are four equations according to four degrees of freedom.
(18) There are four equations, corresponding to the four degrees of freedom.
(18*) There are four equations, because there are four degrees of freedom.

In (13*) and (14*), "according to" is used with the first and second meanings, respectively, given in the previous section. Also, note that the implications of (14) and (14*) are slightly different. (The situation described by the former is within "our scenario," while that described by the latter is not.)

Chapter 4

adapt and *adopt*

The verb *adopt* is often misused in place of *adapt*. In order to avoid this problem, it is only necessary to keep in mind that, as they are usually used in scientific writing, *adapt* means 適応させる, and *adopt* means 採用する or 選ぶ.

The difference between *adapt* and *adopt* is demonstrated by the examples below.

> (1) We adopted this indirect measurement technique for use in determining the velocities of the heavier particles.
> (2) We adapted this indirect measurement technique for use in determining the velocities of the heavier particles.

These sentences are both possible, but their meanings differ. The meaning of (1) is simply that this "measurement technique" was used for the purpose of determining these "velocities." The meaning of (2) is that the technique was first altered in some appropriate way and then used for this purpose.

Grammatically, *adapt* can be (and often is) used with the preposition *to* in constructions like *We adapt A to B.* Here, A is that which is adapted, and B is the target application or target context with respect to which this adaptation is carried out.[1] This construction is illustrated by the following.

> (3) Below we adapt this method to the rotor problem.

Here, the object of the preposition "to" is "rotor problem," and it represents the target application of the adaptation. Contrastingly, *adopt* is never used with this kind of construction. Thus, sentences like the following are not possible.

> (4) We adopt this perturbation procedure to the treatment of non-linear differential equations.

In general, it is not possible to adopt one thing *to* another. There seem to be two possible interpretations of this sentence, as expressed below.

> (4) We adapt this perturbation procedure to the treatment of non-linear differential equations.
> (4*) We adopt this perturbation procedure for the treatment of non-linear differential equations.

[1] In this sentence, A is the direct object of the verb "adapt," and B is the object of the preposition "to."

The meaning of (4) is that the perturbation procedure is appropriately modified for application to the treatment of non-linear differential equations, while the meaning of (4^*) is that this procedure is simply used for this purpose. The following are essentially equivalent to (4^*).

> (4^{**}) We use this perturbation procedure in the treatment of non-linear differential equations.
> (4^{***}) We apply this perturbation procedure to the treatment of non-linear differential equations.

In these sentences, there is no implication that the treatment was modified for the particular application under consideration (although this possibility is not ruled out).

Chapter 5

adequate

In the papers that I proofread, the adjective *adequate* is used incorrectly much more often than it is used correctly. Here I treat its most common misuses.

5.1 Misused as a synonym of *appropriate*

Adequate is not a synonym of *appropriate*. This misuse is demonstrated below.

> (1) This formulation of the problem is more adequate.
> (1) This formulation of the problem is more appropriate.

The main difference between *adequate* and *appropriate* is that the former regards an extent or degree, while the latter regards suitability. (Note that *adequate* is synonymous with *sufficient* and *enough*, whereas *appropriate* is synonymous with *suitable* and *fitting*.) Also, *adequate* is normally used in making a quantitative comparison with respect to some standard,[1] while *appropriate* is not. Thus adequacy is usually a relative concept and quantitative in implication, while appropriateness is usually of a more absolute and qualitative nature. In (1), the statement seems to be with regard to the **strength** of the formulation. Although this is not a completely inconceivable situation, it is somewhat strange. If in fact this were the intended meaning, it would be much more naturally expressed in terms of the adequacy of some more quantifiable aspect of the formulation. For example, the following would be possible.

> (1*) The extent to which this formulation takes into account the secondary reactions is /adequate/sufficient/ to obtain results consistent with experiment.

Here, that described as "adequate" is the "extent," rather than the "formulation." Also, the purpose of obtaining consistency with experiment is explicitly expressed as the standard with respect to which this "extent" is compared. (Note that we could not use *appropriate* here.)

[1]For example, in the sentence *5 cm. of rainfall per month is adequate to maintain the present vegetation density*, the standard is the amount of rainfall needed to maintain the vegetation density.

5.2 General misuse

Below I give examples typifying the misuses of *adequate* that I encounter.[2] While the most common incorrect use of *adequate* is with the intended meaning of *appropriate* or *suitable*, there are other types of frequently occurring mistakes. Some of these too are illustrated in the following sentences.

> (1) Such a purely reductive understanding of natural phenomena is not adequate.
> (1) Such a purely reductive understanding of natural phenomena is /naive/ overly simplistic/not effective in its modeling/.
> (2) While the proof they give is not adequate in general, it does apply to certain cases.
> (2) While the proof they give is not /general/valid generally/appropriate generally/, it does apply to certain cases.
> (3) From this viewpoint, however, the adequateness of using effective forces in the particle-particle channel is not evident.
> (3) From this viewpoint, however, the validity of using effective forces in the particle-particle channel is not evident.
> (3*) From this viewpoint, however, the sufficiency of effective forces in the particle-particle channel is not evident.
> (4) Note, however, that this problem cannot be avoided, even by using physically adequate parameter values.
> (4) Note, however, that this problem cannot be avoided, even by using physically /appropriate/meaningful/reasonable/ parameter values.
> (5) A combination of type-I fixed points and an adequate arrangement of type-II fixed intervals can produce such a map.
> (5) A combination of type-I fixed points and an appropriate arrangement of type-II fixed intervals can produce such a map.
> (6) To continue with the calculation further, it is therefore necessary to apply some adequate perturbative method to the treatment of the second term.
> (6) To continue with the calculation further, it is therefore necessary to apply some suitable perturbative method to the treatment of the second term.
> (7) The single-mode approximation is adequate in this case.
> (7) The single-mode approximation is /adequately/sufficiently/ accurate in this case.
> (7*) The single-mode approximation is /appropriate/justified/ in this case.
> (8) The assumption of temporally uncorrelated inputs was found to be inadequate to account for the experimental data.
> (8) The assumption of temporally uncorrelated inputs was found to be inconsistent with the experimental data.

[2] Many of the incorrect uses of *adequate* considered in this chapter clearly result from the mistaken translation of 妥当 or 適切.

(8*) It was found that with the assumption of temporally uncorrelated inputs, the theory is unable to account for the experimental data.
(9) This functional form is adequate to approximately describe the linear stability.
(9) This functional form is sufficient to give an approximate description of the linear stability.
(9*) This functional form yields a description of the linear stability whose precision is /adequate/sufficient/ for the present purpose.
(10) Adequate strategies for real organisms in the real world, however, are much more complicated.
(10) Strategies that are /adequately/sufficiently/ variable for use by organisms in the real world, however, are much more complicated.
(11) These shapes, however, must be adequately characterized.
(11) These shapes, however, must be appropriately characterized.
(11*) These shapes, however, must be characterized in /an adequately/a sufficiently/ precise manner.
(12) This model is adequate to describe the immune network only when $\gamma = 0$.
(12) This model is capable of describing the immune network only when $\gamma = 0$.
(13) There is no such problem, however, if these quantities are adequately introduced into the Einstein equations, as we show.
(13) There is no such problem, however, if these quantities are /appropriately/correctly/ introduced into the Einstein equations, as we show.
(14) In the case that a black hole is formed, however, this gauge condition is less adequate.
(14) In the case that a black hole is formed, however, this gauge condition is less /valid/appropriate/.
(15) In this case, the maximal slice condition seems to be an adequate condition.
(15) In this case, the maximal slice condition seems to be sufficient.
(16) In this case, it would be more adequate to treat β^z first and take the $Z \to 0$ limit at the end.
(16) In this case, it would be more /valid/appropriate/correct/sound/justified/ to treat β^z first and take the $Z \to 0$ limit at the end.
(17) However, these boundary conditions are inadequate.
(17) However, these boundary conditions are not /appropriate/valid/allowed/sufficiently realistic/.
(18) An entirely different approach, however, is necessary to adequately describe the waveform itself.
(18) An entirely different approach, however, is necessary to accurately describe the waveform itself.
(18*) An entirely different approach, however, is necessary to provide a sufficiently accurate description of the waveform itself.
(18**) An entirely different approach, however, is necessary to provide a description of the waveform that can be compared with experiments.

(19) Because this model has no energy, it is not adequate for a thermodynamic study.
(19) Because this model possesses no energy, it is not appropriate for a thermodynamic study.
(19*) Because this model possesses no energy, it cannot be used for a thermodynamic study.
(20) This solution is only adequate for $B < \eta_0$.
(20) This solution is only /valid/meaningful/appropriate/ for $B < \eta_0$.

Note that in (7), (9*), (10) and (11*), "adequate" and "adequately" are used with regard to readily quantifiable attributes – accuracy, precision and variability.

Chapter 6

agree and *agreement*

The uses of the verb *agree* and noun *agreement* demonstrated by the examples below should be avoided.[1]

Misused in comparing theoretical and experimental results

(1) The predicted value of α agrees well with the experimental result.
(1) The predicted value of α is consistent with the experimentally measured value.
(1*) The predicted value of α is within the error bounds of the experimental result.
(1**) The discrepancy between the predicted and experimental values of α is statistically insignificant.
(1***) The predicted and experimental values of α are of the same order of magnitude.
(1****) The difference between the predicted and experimental values of α is sufficiently small for the present purposes.
(2) The theoretical and experimental curves almost agree.
(2) The theoretical and experimental curves are consistent.
(2*) The theoretical curve is everywhere within the error bounds of the experimental curve.
(2**) The theoretical and experimental curves are inconsistent.
(2***) The fit of the theoretical curve to the experimental curve has a reduced χ^2 value of 1.05.
(2****) The theoretical and experimental curves possess most of the same important qualitative features.
(3) This model exhibits remarkable agreement with the experimental data.
(3) This model accounts for all existing experimental data regarding this behavior.
(3*) The predictions of this model are consistent with all existing experimental data for this behavior.
(3**) The predictions of this model are consistent with almost all existing

[1]The discussion here should be considered in conjunction with that given in Chapter 129.

experimental data for this behavior.
(3^{***}) The predictions of this model agree with the experimental data much better than those of any previous model.
(4) The predicted differential cross sections for ^{40}Ca calculated using RIA are in good agreement with their experimental values in the range 400–800 MeV.
(4) The predicted differential cross sections for ^{40}Ca calculated using RIA are consistent with their experimental values in the range 400–800 MeV.
(4^{*}) Most of the predicted differential cross sections for ^{40}Ca calculated using RIA are consistent with their experimental values in the range 400–800 MeV, although there are some discrepancies.
(5) The agreement between the experimental and theoretical values is not good.
(5) The experimental and theoretical values are inconsistent.
(5^{*}) The theoretical value is far outside the error bounds of the experimental value.
(5^{**}) The theoretical value is more than three standard deviations away from the peak value of the experimentally obtained distribution.
(5^{***}) The theoretical value is more than two orders of magnitude larger than the experimental value.
(6) The solid and dashed curves agree well.
(6) The difference between the solid and dashed curves is everywhere within the bounds of the experimental uncertainty.
(6^{*}) The reduced χ^2 value for the fit of the solid theoretical curve to the dashed experimental curve is 0.91.
(6^{**}) The solid and dashed curves are qualitatively similar.

Misused in comparing different sets of theoretical results

(7) Our result for the thickness dependence of $T(g)$ agrees well with those obtained by the previous methods.
(7) Our result for the thickness dependence of $T(g)$ exhibits the same important qualitative features as those of the previous methods.
(7^{*}) Our result for the thickness dependence of $T(g)$ differs from those obtained using the previous methods by at most a few percent over the entire range of physically meaningful values of g.
(7^{**}) Our result for the thickness dependence of $T(g)$ is effectively identical to those obtained with the previous methods, considering the present experimental uncertainty involved in measuring $T(g)$.
(7^{***}) The agreement between our method and the previous methods is better with regard to the thickness dependence of $T(g)$ than that of $\tilde{T}(g)$.
(8) All the predictions of our scheme agree with those of the T-matrix scheme.
(8) All the predictions of our scheme are identical to those of the T-

matrix scheme.

(8^*) All the predictions of our scheme are effectively equivalent to those of the T-matrix scheme, given the present degree of uncertainty involved in measuring the corresponding values experimentally.

(8^{**}) Present day experiments are not sufficiently precise to determine whether our scheme or the T-matrix scheme provides better predictions.

(9) The theoretical prediction for the value of α at lowest order is in good agreement with numerical simulation.

(9) The theoretical prediction for the value of α at lowest order differs from the that obtained from the numerical simulation by only $\sim 2\%$.

(10) The solid and dashed curves agree well.

(10) The discrepancy between the solid and dashed curves is never more than a few percent.

(10^*) The solid and dashed curves are qualitatively similar.

(10^{**}) The discrepancy between the solid and dashed curves at each point is smaller than the uncertainty involved in generating either.

Misused in comparing different sets of experimental results

(11) The values of μ obtained in our measurements agree well with those measured by Raine.

(11) All the values of μ obtained in our measurements are consistent with those measured by Raine.

(11^*) Most of the values of μ obtained in our measurements are consistent with those measured by Raine.

(12) We find good agreement between the present results for $\gamma(T)$ and those obtained in the previous study, in which the more primitive averaging technique was used.

(12) We find that at all temperatures considered, the present results for $\gamma(T)$ are consistent with those obtained in the previous study, in which the more primitive averaging technique was used.

(12^*) We find that for approximately 90% of the temperatures considered, the present results for $\gamma(T)$ are consistent with those obtained in the previous study, in which the more primitive averaging technique was used.

(12^{**}) We find that over the entire range considered, the present results for $\gamma(T)$ and those obtained in the previous study, in which the more primitive averaging technique was used, possess the same important qualitative features.

(12^{***}) Comparing our results for $\gamma(T)$ and those obtained in the previous study, in which the more primitive averaging technique was used, we obtain a reduced χ^2 value of 1.2, with no obvious systematic trends regarding their discrepancy.

(12^{****}) Properly accounting for the difference in averaging techniques, we find that all of the present results for $\gamma(T)$ are consistent with those obtained in the previous study, in which the more primitive averaging

technique was used.

Misused in comparing mathematical objects and expressions

(13) The constraint equation agrees with the relation $\delta H/\delta\sigma = 0$.
(13) The constraint equation is /identical to/equivalent to/consistent with/ the relation $\delta H/\delta\sigma = 0$.
(13*) The constraint equation results in behavior similar to that obtained by setting $\delta H/\delta\sigma = 0$.
(14) This tensor agrees with that in (5.1) in the case $c = 0$.
(14) This tensor is identical to that in (5.1) in the case $c = 0$.
(14*) This tensor gives the same results as that in (5.1) in the case $c = 0$.
(14**) This tensor and that in (5.1) are consistent.

Misused in place of *identical*, *the same*, *similar*, *equal* and related expressions

(15) These two potentials agree only in the range of intermediate values of r.
(15) These two potentials /are similar/have similar forms/ only in the range of intermediate values of r.
(15*) These two potentials coincide only in the range of intermediate values of r.
(16) The value that we obtained, $\beta = 1/2$, disagrees with that found in Ising-like models, $\beta = 1/8$.
(16) The value that we obtained, $\beta = 1/2$, is different from that found in Ising-like models, $\beta = 1/8$.
(17) For $s = 0$, this ordering agrees with the that in the symmetric case.
(17) For $s = 0$, this ordering is the same as that in the symmetric case.
(18) If a_n agrees with one of earlier a_i $(i = 1, 2, \dots, n-1)$, the network is reduced to a cycle.
(18) If a_n /is identical to/coincides with/ one of a_i $(i = 1, 2, \dots, n-1)$, the network is reduced to a cycle.
(19) In this case, $\psi_{ij} = 1$ when the square size agrees with the grid size.
(19) In this case, $\psi_{ij} = 1$ when the square size and the grid size are /identical/equal/.
(20) The two values ν and $\tilde{\nu}$ agree.
(20) The two values ν and $\tilde{\nu}$ are equal.
(20*) The difference between ν and $\tilde{\nu}$ is small, relative to $\delta\mu$.
(20**) The two values ν and $\tilde{\nu}$ do not lead to a contradiction.
(20***) The two values ν and $\tilde{\nu}$ are consistent.
(20****) The difference between ν and $\tilde{\nu}$ is insignificant, given the current precision of experimental results.
(21) This figure agrees with the bifurcation diagram of the logistic map.
(21) This figure is identical to the bifurcation diagram of the logistic map.
(21*) This figure is indistinguishable from the bifurcation diagram of the logistic map.

(21**) The qualitative features of this and the bifurcation diagram of the logistic map are the same.
(21***) This figure is very similar to the bifurcation diagram of the logistic map.

Misused in comparing things that cannot be directly compared

(22) This empirical finding agrees with the concept of the dynamic brain.
(22) This empirical finding is consistent with the concept of the dynamic brain.
(23) This fact agrees with the result of Insdi [4].
(23) This fact is consistent with the result of Insdi [4].
(24) This interpretation agrees with the recently proposed partial inhibition theory.
(24) This interpretation is /consistent/compatible/ with the recently proposed partial inhibition theory.
(25) This asymptotic behavior agrees well with Ref. 12.
(25) This asymptotic behavior is similar to that found in Ref. 12.
(25*) This asymptotic behavior is identical to that found in Ref. 12.
(25**) This asymptotic behavior is /identical to/consistent with/ that predicted in Ref. 12.
(25***) This asymptotic behavior is consistent with the data presented in Ref. 12.

Discussion

The original sentences here have two main problems resulting from the misuse of "agree" and "agreement." First, these sentences lack clear, unique interpretations, and, second, without the reader adding new meaning, most of their possible interpretations themselves are problematic.[2] These sentences are in the best cases vague and in the worst cases almost meaningless. For example, consider the expression "agrees well" in (1). When encountering this expression, the reader can only guess what the author has in mind. It seems that perhaps the intended meaning is something like that expressed by one of the rewritten versions, but there are many other possibilities, including the possibility that this sentence is simply expressing the author's personal opinion. Most of the remaining examples are similar.

A comparison of different investigational results is meaningful in a scientific sense only to the extent that it is expressed in an objective manner. Thus, in general, when making such a comparison, it is necessary to use precise statements that make clear both the nature of the comparison (that is, the aspect or aspects of these results that are being compared and the means or measure with respect to which their relationship is being judged) and its outcome. Simply asserting that such

[2] It seems that one (but certainly not the only) cause of the misuse of *agree* and *agreement* is their direct translation from 一致する and 一致. While there are cases in which these Japanese words can be translated as *agree* and *agreement*, in scientific and mathematical contexts, usually this is not the case.

results ‘agree’, ‘agree well’, exhibit ‘good agreement’, etc., accomplishes neither. In proofreading papers, the misuse of such assertions in place of more scientifically meaningful statements is perhaps the single most serious problem that I encounter, and, considering the severity of the problems such expressions create, this misuse is surprisingly common. In (1), while it is clear what aspects of these results are being compared, it is clear neither by what measure their relationship is being judged (e.g., the absolute magnitude of their difference, this magnitude as measured with respect to the experimental uncertainty, this magnitude as measured with respect to the precision needed for some application, etc.) nor what the outcome of this comparison is. The problem in (2) is even more serious, as here, it is not even clear whether it is the quantitative values or the qualitative features of these two sets of results that are being compared.

In the above original sentences, “agree” and “agreement” can be interpreted either in such a manner that these sentences express no definite meaning, and therefore that drawing a definite conclusion about both the nature of the comparison and its outcome is left to the reader, or in such a manner that they express some kind of absolute meaning, i.e., that the agreement in question is an absolute condition. In the former case, these statements serve no purpose. In the latter case, the implication is that there is no objective means or measure by which the relation between the results is being judged, and for this reason the reader can only conclude that this judgment is nothing more than the author’s opinion. In this case, while these statements do serve some purpose, they are essentially meaningless from a scientific point of view.

In scientific contexts, the condition of *agreement* is usually regarded as existing in degrees and being meaningful only in comparison to some standard. In the above original examples, because “agree” and “agreement” are not used in such a manner, they do not allow scientifically meaningful interpretations. However, note that the situation is different in (3***) and (7***). The following provide further examples of the scientifically meaningful use of these words.

> (26) We hope that this small modification of the Lagrangian improves the agreement between theory and experiment.
> (27) Figure 1 reveals that the predictions obtained from the higher-order approximation agree better with the numerical results.
> (28) The agreement between these values improves as σ increases.
> (29) The agreement between these values is sufficient for almost any technical application.

Here, “agreement” and “agree” are clearly used in reference to attributes that exist in degrees, and the assertions of these sentences, like those of (3***) and (7***), are of a relative nature, comparing such degrees in different cases or with respect to some objective standard.

I now give specific discussion of some of the above examples.

While (1*) and (1**) would be appropriate in different situations, (1) could be used in place of either. Note that, unlike that of *agreement*, the condition of *consistency* does not require a standard of comparison to be meaningful.[3]

[3] Two results are consistent if the validity of one does not necessarily imply the invalidity of the

The meanings expressed by (2) and (2*) are essentially the same, although (2) could be used in a wider variety of situations.

The type of use demonstrated by "remarkable" in (3) should be avoided. (For further discussion, see Chapter 108.) While the intended meaning here is quite unclear, the rewritten forms express what appear to be the most likely possibilities. Note that (3) and (3*) express the same meaning.

When encountering (4) and (7), the reader can only guess in comparison to what or with respect to what standard the stated agreement is "good" and the dependences in question "agree well."[4] Because no such information is provided to the reader, these assertions are completely subjective. Owing to the ambiguity of these original sentences, the rewritten versions represent nothing more than conjectures about the nature of the actual situations under consideration.

The problem in (8) is quite similar to that in (7). Note that (8*) and (8**) express essentially the same meaning.

As is the case for many of the examples here, because (9) contains no objective information, it provides the reader with essentially no new knowledge. The rewritten version represents one way in which such information could be added.

I quite often find *agree* used in the manner demonstrated by (13), in which it is unclear if the intended meaning is that the two things in question are identical or simply not contradictory. Here, note that the three versions of (13) express quite different meanings, but each regards these equations themselves. Contrastingly, (13*) regards their role in some larger system.

Similarly to (13), (14) does not make clear whether these tensors are identical, equivalent with regard to the present application, or simply not inconsistent. These are very different characterizations.

As illustrated by (15)–(21), *agree* should never be used to in place of *identical*, *coincident*, *equal*, *the same* or *similar*. *Agree* simply does not possess such meanings.

In most of the examples considered to this point, "agree" and "agreement" are used to compare two things that can be directly compared (for example, theoretical and experimental results for one particular quantity). In (22)–(25), however, this is not the case. Here, there is no direct correspondence between the things that "agree" is being used to compare. (For example, in (22), these "findings" do not correspond to the concept of the dynamical brain as a whole but, rather, to some particular aspect of it.) In such situations, *agree* and *agreement* are inappropriate and, in fact, illogical. This is particularly true in (25), in which things of two completely different types ("asymptotic behavior" and "Ref. 12") are being compared. Note that "identical to" in (25**) could be used only in the case that "this asymptotic behavior" is of a theoretical nature. The difference between (25*) and (25**) with "identical to" is that the latter implies that the asymptotic behavior found in Ref. 12 is regarded as modeling the behavior of a physical system, while the former does not.

other. Of course, in general, the implication of a statement that two results are consistent depends on the nature of the results in question. In perhaps the simplest situation, this implication is that for some quantity of interest, its theoretically determined value falls within the range of uncertainty on its experimentally determined value.

[4] Extensive discussion of the misuse of *good* and *well* is presented in Chapter 129.

Chapter 7

aim, *goal*, *purpose*

7.1 Introduction

While the nouns *aim*, *goal* and *purpose* are all similar, and in fact share certain meanings, they are not always interchangeable. I often find these words inappropriately substituted for each other.[1]

7.1.1 Preliminary considerations

As a first step toward an understanding of their differences, it is worthwhile comparing the proper uses of *aim*, *goal* and *purpose* demonstrated by (1) and (2) and the improper uses demonstrated by (1) and (2) below.

(1) Our goal is to reach this purpose.
(1) Our purpose is to reach this goal.
(2) For the aim of better understanding this system, our purpose is to reconstruct the previous proof in a more general context.
(2) For the purpose of better understanding this system, our aim is to reconstruct the previous proof in a more general context.

7.1.2 Unique meanings of *goal*, *aim* and *purpose*

The meaning that distinguishes *goal* from *aim* and *purpose* is that of *destination* or *point of culmination*: In general, a goal can be thought of as a place (real or abstract) toward which effort is directed. This meaning is clearly demonstrated by (1) above. Note that in this sentence, "goal" could be replaced by neither *purpose* nor *aim*.

The meaning that distinguishes *purpose* from the others is that of *reason* and *motivation*: A purpose can include the reason that some thing exists or the motivation with which some action is carried out. For example, the idea expressed by (1) is that reaching this "goal" is what motivates the action to be carried out. As expressed by this sentence, purpose motivates action. While "purpose" here could

[1] As seen from the discussion given in this chapter, careful consideration of the intended meaning is necessary to properly translate 目的.

be replaced by *aim*, the meaning of motivation would be lost. Note also that in (2), "for the purpose" could be replaced by *with the motivation*. As demonstrated by (2), here "aim" is not possible. The following further illustrates the unique meaning of *purpose*.

> (3) The purpose of this procedure is the construction of complete sets of solutions.

In this sentence, "purpose of" could be replaced by *reason for the existence of*. Again here, it is the stated purpose that is seen as the motivation for carrying out the action (i.e. "this procedure"). In this sentence, "purpose" could not be replaced by *aim* or *goal*.

The meaning that distinguishes *aim* from the others is that of *direction*: An aim can include the direction or path taken toward some goal as well as the intention and act of directing oneself in such a direction or along such a path. This meaning is seen in (2). There, the idea is that the path taken in the attempt to better "understand this system" is the "reconstruction of the previous proof." This meaning is further demonstrated by the following.

> (4) Our aim is to construct such a theory step by step, by first constructing theories in many specific cases and then combining these in some manner.

Here, "our aim" could be replaced by *the approach we take* or *the path we follow*. It is important to note that in the situation described by this sentence, in contrast to the aim, the purpose is simply to "construct such a theory." It does not include the method of construction described here. For this reason, "aim" could not be replaced by *purpose*. Although *goal* would not be as inappropriate as *purpose*, it would be somewhat unnatural for a similar reason.

7.1.3 *aim* vs. *purpose*: specific and nonspecific

A further difference between *aim* and *purpose* can be understood from the examples below.

> (5) Our purpose is to investigate the more general case.
> (6) Our aim is to determine the value of this exponent in the more general case.

As demonstrated by these sentences, *purpose* is used more naturally with respect to broad, unspecific and vaguely defined intentions, while *aim* is used more naturally with respect to narrow, specific and clearly defined intentions. Neither "purpose" nor "aim" could be changed to the other in the above. (*Goal* could be used in (6), but not in (5).) The difference illustrated by these examples is clearly consistent with the meanings discussed above: While a broad and vaguely defined intention can motivate action, it does not offer direction. This difference between *aim* and *purpose* is also seen in (1), (2) and (5) of the next section.

7.1.4 *purpose* vs. *aim* and *goal*: use with *for*

The following example provides a different way of considering the differences among *aim*, *goal* and *purpose*.

> (7) For this /aim/goal/, we carried out numerical computations in each energy region.
> (7) For this purpose, we carried out numerical computations in each energy region.
> (7*) With this aim, we carried out numerical computations in each energy region.
> (7**) To attain this goal, we carried out numerical computations in each energy region.

The preposition "for" in (7) and (7) indicates that the action of carrying out the numerical computations was done to serve the "aim/goal" and "purpose," respectively. However, although the concept of an action serving a purpose is very natural, that of an action serving an aim or goal is very strange. This is because, while the most natural relationship between an action and a purpose is that the former *carries out* (i.e. *serves*) the latter, that between an action and an aim is that the former is *determined by* or *directed by* the latter and that between an action and a goal is that the former is *directed at* the latter.

7.2 Examples

In this section I give a number of examples demonstrating the proper and improper uses of *aim*, *goal* and *purpose*. It should be noted that the inappropriateness of these words in the original sentences varies a great deal. In some cases, the originals are only slightly unnatural.

> (1) The aim of this paper is to study the retrieval dynamics of two types of neural networks.
> (1) The purpose of this paper is to study the retrieval dynamics of two types of neural networks.
> (2) The aim of this article is to provide an overview of the perturbative methods in QCD.
> (2) The purpose of this article is to provide an overview of the perturbative methods in QCD.
> (3) For the aim of detailed data examination, we employ here an additional statistical coefficient defined below.
> (3) For the purpose of detailed data examination, we employ here an additional statistical coefficient defined below.
> (4) For the goal of simplifying the proof of (8.3), we introduce the quantity τ^* defined as follows:
> (4) For the purpose of simplifying the proof of (8.3), we introduce the quantity τ^* defined as follows:
> (5) Our purpose in the present section is to prove the uniqueness of the

solution U using the result of the previous section.

(5) Our aim in the present section is to prove the uniqueness of the solution U using the result of the previous section.

(6) Since our aim is to derive ψ, we would like to get rid of the second term on the right-hand side of Eq. (2.3).

(6) Since our goal is to derive ψ, we would like to get rid of the second term on the right-hand side of Eq. (2.3).

(7) The purpose of the present study is to fit the result of simulations to experimental data.

(7) The aim of the present study is to fit the result of simulations to experimental data.

(8) The aim of this paper is a case study of the β functions on $GL(2, \mathbf{C})$.

(8) The purpose of this paper is to carry out a case study of the β functions on $GL(2, \mathbf{C})$.

(8*) The goal of this paper is to complete a case study of the β functions on $GL(2, \mathbf{C})$.

(9) Our purpose here is to determine which intervals I_j^2 can generate a map of the form (1).

(9) Our goal here is to determine which intervals I_j^2 can generate a map of the form (1).

(10) Our purpose is to arrange the fixed points so that $h_n(x')$ is directed at least two of them.

(10) Our goal is to arrange the fixed points so that $h_n(x')$ is directed at least two of them.

(11) Our /aim/goal/ is to clarify the role of modulation in multiple pattern generation.

(11) Our purpose is to clarify the role of modulation in multiple pattern generation.

(12) Our purpose is to rewrite the expression (3.1) in terms of the physical parameters α, β and γ using the relations (2.5)–(2.15).

(12) Our /aim/goal/ is to rewrite the expression (3.1) in terms of the physical parameters α, β and γ using the relations (2.5)–(2.15).

(13) The main goal of this paper is to investigate the changes undergone by the network after the invasion of antigens.

(13) The main purpose of this paper is to investigate the changes undergone by the network after the invasion of antigens.

(14) Our main aim is to clarify the spin structure of the Cooper pair.

(14) Our main purpose is to clarify the spin structure of the Cooper pair.

(14*) Our main aim is to compute the functions that reveal the spin structure of the Cooper pair.

(14**) Our main goal is to determine the functions that reveal the spin structure of the Cooper pair.

(15) The goal of the SR approximation is to determine the functions h and g that maximize the variational partition function per site.

(15) The purpose of the SR approximation is to determine the functions

h and g that maximize the variational partition function per site.

Examples (1) and (1) demonstrate the point made concerning (5) and (6) of the previous section. Examples (2) and (2) are similar in this regard. Examples (3) and (4) are similar to (7) of the previous section. The problem with (5) is that because the action in question is clearly defined and quite specific, "aim" is better than "purpose." Also, the idea of the path taken to this desired result is expressed. In (6), because the derivation of ψ is truly an endpoint, "goal" is better than "aim." The problem with (7) is that the "fitting" mentioned here is better thought of as simply a process to be carried out than something that provides motivation. Examples (8)–(8*) offer a good way of comparing *purpose* and *goal*. The meaning expressed by (8) is that this "case study" provides the meaning for the existence of the paper, while that expressed by (8*) is that the intended endpoint is the completion of the case study. In (9), "goal" is better than "purpose," because the determination of interest is best considered an endpoint. Example (10) is similar. Because the act of clarifying expressed in (11) is unspecific, "aim" here is poor, and because, in general, it is something that exists in seemingly limitless degrees (i.e., in science, there is generally no limit of the degree to which something can be clarified), "goal" is inappropriate. Example (12) describes a situation that is opposite in this respect. Here, the action in question is quite clearly defined and has an absolute endpoint. It is instructive to note the similarity between (13) and (11). Examples (14)–(14**) present a good comparison of the three words. Because we usually do not think in terms of a computational procedure as having a goal (rather, it is **we** who have a goal in using such a procedure), (15) depicts an unnatural situation. Here the idea is clearly that determining such functions is the role played by (i.e. the reason for the existence of) this approximation, and thus "purpose" is the best choice.

7.3 Related words

I end this chapter with discussion of some additional related words. The nouns *objective*, *object*, *intention*, *intent*, *end*, *motivation*, *design* and *plan* are, to varying degrees, similar in meaning to *aim*, *goal* and *purpose*.[2] *Objective* is very close in meaning to *goal*, but while a goal is usually thought of as a desired destination, an objective is more naturally thought of as a desired accomplishment. For this reason, we can say that we *arrive at a goal*, *achieve a goal* or *realize a goal*, but we *accomplish an objective*. *Object* is similar to *objective*, but it has a stronger meaning of purpose. *Intention* is quite similar to *objective*, but it also includes the meaning of an intended course of action. Thus, we can say that we *carry out our intention*, though we could not use *goal* or *objective* in such an expression. *Intent* is close to *intention*, but it possesses a stronger meaning of deliberateness and determination. In this sense, it is similar to *purpose*. *End* differs from *goal* in that it can mean simply a result, intended or not. *Motivation* differs from *goal* in that it lacks the meaning of an endpoint of directed action, while it possesses the meaning of actually causing such action, and thus is similar to *purpose*. *Design* and *plan* are similar to *aim* in that they regard the intended path taken in reaching a goal.

[2]It should be noted that each of these words has meanings that are not discussed here.

Chapter 8

all and *both*

There are a number of problems I encounter involving use of *all* and *both*. Here I treat the most pervasive of these. The problems considered in Sections 1, 2 and 3 are identical for *all* and *both*. The problem considered in Section 4 is unique to *all*.

8.1 Ambiguous use with negative expressions

Use of the adjectives *all* and *both* in negative expressions often results in ambiguity. In this section I discuss the most serious such problems.[1]

8.1.1 Modifying the subject

The most common situation in which use of *all* and *both* in negative assertions results in ambiguity is demonstrated by the following.

> (1) In the target region, all the systematic factors scaling the detection efficiency were not included.
> (1) In the target region, not all of the systematic factors scaling the detection efficiency were included.
> (1*) In the target region, some of the systematic factors scaling the detection efficiency were not included.
> (1**) In the target region, none of the systematic factors scaling the detection efficiency were included.
> (2) Both procedures cannot be accounted for.
> (2) At least one of the procedures cannot be accounted for.
> (2**) Neither of the procedures can accounted for.
> (3) All poles of Φ are not inside this path.
> (3) Not all poles of Φ are inside this path.
> (3*) Some of the poles of Φ are not inside this path.
> (3**) None of the poles of Φ are inside this path.
> (4) For the purpose of generality, we assume that all frequencies are not equal to Ω.

[1] The problems considered here are similar to those involving *any* treated in Chapter 12 and *each* and *every* treated in Chapter 52.

(4) For the purpose of generality, we assume that none of the frequencies are equal to Ω.
(4*) For the purpose of generality, we assume that not all of the frequencies are equal to Ω.
(4**) For the purpose of generality, we assume that some of the frequencies are not equal to Ω.

In each of the original sentences above, the main verb expresses some kind of negative meaning,[2] and the subject of this verb is modified by "all" or "both." Almost always, this type of sentence is ambiguous, because it is not clear what is being negated. For example, in (1), it is unclear whether "not included" describes the state of "all the systematic factors" as a whole, or if "not" only negates "all." On purely grammatical grounds, the former would seem to be the intended meaning, but in fact the latter is actually the more natural interpretation. In the former case, the expression "all the systematic factors" is understood as a single unit, describing a single entity (these "factors" as a whole) characterized by the single property of being "systematic." In the latter case, "all" seems to be, in some sense, separated from the noun it modifies, and therefore "all the systematic factors" is understood as describing a number of individual units (the "factors" considered individually), each of which may be "systematic" in its own way. The first interpretation is unambiguously expressed by (1**), and the second by (1) and (1*).

The remaining examples are all similar to the first. In each case, the rewritten versions clearly express the possible interpretations of the original sentences. Note that the meanings of (3) and (3*) are the same, as are those of (4*) and (4**).

8.1.2 Acting as the subject

The situation in which the pronoun *all* or *both* acts as the subject of a negative predicate is essentially the same as that discussed above. The following is a typical example.

(5) All of the terms do not appear.
(5) Not all of the terms appear.
(5*) Some of the terms do not appear.
(5**) None of the terms appear.

Note that (5) and (5*) have the same meaning.

8.1.3 Other ambiguous use

The following sentences are not of the type presented above.

(6) We assume that there is no turning point for all $\mu' \in (\mu_1, \mu_3)$.
(6) We assume that there is no turning point for any $\mu' \in (\mu_1, \mu_3)$.

[2] In grammatical terms, we say that these sentences possess negative predicates. In (1) and (4), the adverb "not" modifies the predicate adjectives "included" and "equal," in (2) there is the negative auxiliary verb "cannot," and in (3), the adverb "not" modifies the prepositional phrase "inside this path."

(6*) We assume that there does not exist a single turning point common to all $\mu' \in (\mu_1, \mu_3)$.
(7) The inverse operations are not defined in both cases.
(7) The inverse operations are not defined in either case.
(7*) The inverse operations are not defined for at least one case.

As in the previous examples, here the adjectives "all" and "both" are used in negative assertions (negative predicates). Unlike in the previous examples, however, in (6) and (7), these adjectives do not modify the subject of the main verb but rather the object of a preposition (namely, "for" and "in"). As we see, this type of construction too can lead to ambiguity. Here again, the problem results from the fact that it is unclear what is being negated. For example, in (6), it seems that this could be either "is" or "all." The rewritten versions express the various possible interpretations of the originals. In situations like the above, most commonly the intended meaning is obtained by replacing *all* by *any* or *some* and *both* by *either* or *at least one*. Note, however, that in the first example, the statement obtained by changing "all" to *some* does not represent a possible interpretation of the original.

8.2 Ambiguous use with *either...or* and *or*

The following illustrates another way in which ambiguity can result from the careless use of *all* or *both*.

(1) All terms are either purely real or purely imaginary.
(1) Each term is either purely real or purely imaginary.
(1*) Either all terms are purely real or all terms are purely imaginary.
(2) All of these conclusions are incorrect or nonsensical.
(2) Each of these conclusions is either incorrect or nonsensical.
(2*) Either all of these conclusions are incorrect or they are all nonsensical.

The two possible interpretations of (1) are expressed unambiguously by (1) and (1*). The problem here obviously results from the use of "all" with "either...or." Because the original sentence begins with "all," that which follows is understood as applying simultaneously to all terms in question. However, it is unclear how "either...or" acts within this structure. In general, when there exist a number of individual entities for which there are multiple possible cases that can be realized independently for each entity, *each* should be used instead of *all*, as in (1). Contrastingly, if there are a number of different individual entities to which some possible cases can apply only uniformly, those expressions that describe these cases should form the basic structure of the sentence, as in (1*). Note that the basic structure of (1*) is *either A or B*, where the idea of "all" is embedded in both A and B. The situation is similar in the second example.

8.3 Misused to modify a list of nouns

Consider the following.

(1) All the Σ_x, Σ_y and Σ_z sectors are bounded.
(1) The sectors Σ_x, Σ_y and Σ_z are all bounded.
(2) Both the τ and τ^* spaces are separable.
(2) The τ and τ^* spaces are both separable.

The implication of (1) is that there are multiple sectors in Σ_x, multiple sectors in Σ_y, and multiple sectors in Σ_z. The intended meaning, that Σ_x, Σ_y and Σ_z each represents a single sector and that each of these is bounded, is expressed by (1). The problem with the original is that "all" is an adjective modifying "Σ_x, Σ_y and Σ_z sectors," and "all the Σ_x, Σ_y and Σ_z sectors" is understood as meaning *all the Σ_x sectors, all the Σ_y sectors, and all the Σ_z sectors*. The only possible interpretation is thus that there are multiple sectors of each *type*, Σ_x, Σ_y and Σ_z. In (5), by contrast, "all" is a pronoun that refers to "Σ_x, Σ_y and Σ_z sectors."[3] The situation in (2) is essentially the same. In these examples, the problem results from the placement of "sectors" and "spaces." Because these appear after "Σ_x, Σ_y and Σ_z" and "τ and τ^*," it seems that each of these mathematical symbols represents a type of sector or space and that there are multiple sectors or spaces within each such type. This problem could be solved by simply placing "sectors" before "Σ_x, Σ_y and Σ_z" and "spaces" before "τ and τ^*," but the rewritten versions above are more clear.

8.4 Misused to modify singular nouns

In some situations, *all* can be used to modify a singular noun with a meaning something like *entire* or *the entirety of*. Such use is illustrated below.

(1) There is one conspicuous characteristic common to all physical law.
(2) All the world has been affected by acid rain.

In its most common usage, *all* means *every one of, collectively* with respect to multiple things. For this reason, it is usually used to modify a plural noun. In the above, however, it is being used to modify singular nouns. The reason that it can be used this way here is that these are collective nouns. In (1), "physical law" refers collectively to the set of all individual physical laws, while in (2), "the world" refers collectively to all things – places, animals, human society, etc. – that exist on Earth.

I sometimes find *all* used to modify noncollective singular nouns. This usage should be strictly avoided. The following are typical.

(3) The vesicle states are found in the case that many multilayered vesicles are distributed in all region.
(3) The vesicle states are found in the case that many multilayered vesicles are distributed in the entire region.
(4) Subtracting the area of the type-1 membranes from all area of membranes, we obtain the area of the type-2 membranes.
(4) Subtracting the area of the type-1 membranes from the area of all membranes, we obtain the area of the type-2 membranes.

[3] See Chapter 9 for related discussion.

It appears that the authors of the original sentences considered the nouns “region” and “area” to be collective. This is a misconception.

Chapter 9

all of and related expressions

In general, expressions like *all of*, *any (one) of*, *both of*, *each (one) of*, *every one of*, *many of* and *some of* can only be used when appearing before a term that collectively represents the set of things in question. In other words, the object of the preposition *of* must be a single noun (either a plural noun or a collective noun), rather than a series of nouns. Thus, while expressions like *both of these*, *some of them*, *all of the equations* and *each of the following* are possible, expressions like *both of x and y* are not. The following are typical examples of this mistaken use.

(1) In two dimensions, both of $p_1 = N$ and $p_2 = 1/N$ are satisfied.
(1) In two dimensions, both $p_1 = N$ and $p_2 = 1/N$ are satisfied.
(1*) In two dimensions, both of the equalities $p_1 = N$ and $p_2 = 1/N$ are satisfied.
(1**) In two dimensions, the equalities $p_1 = N$ and $p_2 = 1/N$ are both satisfied.
(2) We regard all of x, y and z to be positive.
(2) We regard x, y and z to all be positive.
(2*) We regard the three parameters x, y and z to be positive.
(3) Even if some of c_1, c_2 and c_3 vanish, this equation cannot be readily solved.
(3) Even if one or more of the quantities c_1, c_2 and c_3 vanish, this equation cannot be readily solved.
(4) Each of a, $\tilde{a}$, b and $\tilde{b}$ is a member of this set.
(4) Each of the quantities a, $\tilde{a}$, b and $\tilde{b}$ is a member of this set.
(4*) The quantities a, $\tilde{a}$, b and $\tilde{b}$ are all members of this set.

Note that in (1), the problem is solved by simply deleting "of." This is possible because a construction of the form *both A and B + [verb]* has the same meaning as *A and B + [verb] + both*. For the other expressions considered here, however, the problem is not so easily resolved. For example, *all A, B and C + [verb]* implies that there are multiple A, multiple B, and multiple C, and "all" is used in reference to every one of these collectively.[1] For this reason, it is seen that we could not simply delete "of" in (2). The situation is similar for *each of*, *many of* and *some of*. For each example above, all rewritten versions express the same meaning.

[1] See Section 3 of Chapter 8 for related discussion.

Allow me to finish this chapter by remarking on a point of grammar unrelated to the present discussion. Note that (2) contains the split infinitive "to all be." Although such constructions can result in awkwardness, they are not necessarily 'wrong', and in some cases, as here, they can be very natural.

Chapter 10

already

10.1 Incorrect usage

In the papers that I proofread, the adverb *already* is greatly overused. In almost all cases that I encounter this word, it is simply unnecessary.[1] The following are typical examples.[2]

(1) Some attempts have already been made to go beyond the mean-field calculation.
(1) Some attempts have been made to go beyond the mean-field calculation.
(2) This point has already been discussed in Ref. [4].
(2) This point is discussed in Ref. [4].
(3) An approximation method reducing the dimensionality of the variational equation has already been proposed by Pettin [2].
(3) An approximation method reducing the dimensionality of the variational equation has been proposed by Pettin [2].
(4) Their results already revealed that this value is too small.
(4) Their results have revealed that this value is too small.
(5) This analysis has already been applied in previous studies.
(5) This analysis has been applied in previous studies.
(6) Correspondingly, some related theoretical models have been already proposed in recent years.
(6) Correspondingly, some related theoretical models have been proposed in recent years.
(7) We have already seen in Fig. (1) that this happens near n_0.
(7) As shown in Fig. (1), this happens near n_0.
(8) For the cases $i = 0, 1, \ldots, p-1$, this conjecture has already been proved in Proposition 2.3.
(8) For the cases $i = 0, 1, \ldots, p-1$, this conjecture is proven in Propo-

[1] As some of the examples given here demonstrate, there are many cases in which it is not necessary to include *already* in order to express the meaning of もう or すでに.

[2] The superfluous use of *already* considered here should be compared with that of the related terms *anymore* (Chapter 13) and *yet* (Chapter 133).

sition 2.3.
(9) The same critical exponent has already been obtained in Ref. [12].
(9) This critical exponent was first obtained in Ref. [12].
(9*) The same critical exponent is obtained in Ref. [12].
(10) As already discussed, this effect is very small.
(10) As discussed above, this effect is very small.
(10*) As previously discussed [3], this effect is very small.

It should be noted that (10) and (10*) express different meanings. The former implies that the discussion referred to is given in the present work, while the latter implies that it is given in some previous work.

10.2 Correct usage

As illustrated by the above examples, in general, when something is stated in the past, present perfect or past perfect tense, the meaning that the action or state in question took place or came into being at or during a previous time is clear, and therefore *already* is not needed to convey such a meaning. Generally, *already* should be used only when a particular type of emphasis is necessary. To understand this, let us consider the pairs of examples below.

(1) A complete linear stability analysis of this equation has been carried out.
(1′) A complete linear stability analysis of this equation has already been carried out.
(2) The effect of the coupling is implicitly included in (4.1).
(2′) The effect of the coupling is already implicitly included in (4.1).
(3) It is well known that τ diverges in this limit.
(3′) It is already well known that τ diverges in this limit.

All of these sentences are feasible. However, the two sentences in each pair differ in connotation. The appearance of "already" in (1′) implies that the fact that this analysis has been carried out previously is in some sense counter to expectation. This sentence would therefore be appropriate, for example, in the situation that the discussion leading up to this point may have led the reader to believe that such an analysis is to be carried out in the present paper. In (1) there is no such special implication. In (2′) there is the underlying meaning that – for whatever reason – until this point, the reader would not have expected that this "effect" is included in "(4.1)," while (2) is completely neutral in this regard. The difference between (3) and (3′) is similar. The latter would be appropriate in the situation that the nature of τ in "this limit" had been considered a point in question.

As the above examples demonstrate, use of *already* generally imparts the meaning that the event, action or state of interest has taken place or been realized in a shorter time or at an earlier stage than may have been expected or than may be regarded as 'usual'.[3] Below I give further examples of its proper use.

[3] Note that *yet* (see Chapter 133) when acting as a synonym of *at this time* or *thus far* is used in the opposite situation.

(4) This problem was first considered in its original form in 1962, and already by 1964 there were at least fifteen independent formulations of it with many papers published concerning each.
(5) In general, at this point we would have to apply a normalization procedure, but it happens that the form of ϕ given by (3.3) is already properly normalized.
(6) While we would like to carry out this procedure to at least second order in the coupling constant, the calculation is too complicated already at first order.
(7) But we found that there is no reason to continue the experiment, because the amount of data we had collected in the first ten runs already surpassed our computational ability for its analysis.
(8) This change causes further increase of the current, which was already well beyond the critical value.
(9) As shown above, Proposition 2 holds if and only if conditions (i)–(iv) hold. In order to prove this proposition, we therefore consider these individually. Condition (i) has already been proven [2], so let us begin with condition (ii).

In (4), the implication is that during this two year time period, the investigation of the problem under consideration developed at a very rapid rate. The meaning expressed by (5) is that the normalization of ϕ prior to the present point in the analysis is not typical. Examples (6) and (7) both convey the idea that some problem has arisen at an earlier stage than expected. In (8), there is the implicit meaning that this current is exceptionally large. The idea expressed by "already" is that, given that the current increases "further," the fact that it was well beyond the critical value even before this is in some sense unusual. The situation may appear to be somewhat different in (9), as there would seem to be nothing unusual or unexpected about the stated condition being previously proved. However, with regard to the important point concerning the use of *already*, the situation here is in fact quite similar. Upon reading the first two sentences, the reader is most naturally led to believe that the author will now carry out the proof of Proposition 2 by proving each of these conditions. Given this expectation, then, the third sentence provides information that the proof of condition (i) took place at an earlier time than presumed. In (5)–(9), "already" is necessary or, at least, desirable, as these sentences would be somewhat unnatural without it. In (4) it is simply used for emphasis.

Chapter 11

and so on, and so forth, etc.

I find the expressions *and so on*, *and so forth* and *etc.* to be overused by Japanese authors.[1] It is best to avoid these when possible, because usually they add essentially no information. The following is a typical example of their misuse.

> (1) This is a common mathematical problem encountered in many fields of study, including theoretical biology, finance, statistical physics, etc.
> (1) This is a typical mathematical problem encountered in many fields of study, including theoretical biology, finance and statistical physics.

Because "including" appears here, it is clear that the list of fields given is not exhaustive. For this reason, "etc." adds no information. As demonstrated by this example, *and so /on/forth/* and *etc.* should generally not be used when a list of examples is introduced by *including*, *such as*, *like*, or any other expression indicating that the list is not complete.

There are several ways to avoid using *and so /on/forth/* and *etc.* I now give some representative examples.

> (2) We conducted experiments using probes made of silver, gold, copper, etc.
> (2) We conducted experiments using probes made of silver, gold, copper and several other metals with high thermal conductivity.
> (2*) We conducted experiments using probes made of several materials, but mainly we used silver, gold and copper.
> (2**) We conducted experiments using probes made of several materials, including silver, gold and copper.
> (3) This can be done by applying a phase-averaging technique [3], a time-averaging technique [4], and so on [5–8].
> (3) This can be done by applying a phase-averaging technique [3], a time-averaging technique [4], and several related techniques [5–8].
> (3*) This can be done by applying a phase-averaging technique [3] and a time-averaging technique [4], as well as some other, somewhat loosely related techniques [5–8].

[1] As seen from the examples considered here, expressions like *and so on*, *and so forth* and *etc.* are used less often than など.

(4) The most interesting situations are realized in atmospheric flow, oceanic flow, etc.

(4) The most interesting situations are realized in such large-scale flow as atmospheric and oceanic currents.

The implication of “etc.” in (2) is somewhat unclear. One possible interpretation is that the unmentioned substances are similar to these three metals – for example, because they have high thermal conductivity. Such a meaning would be more clearly expressed by something like (2). The second possible interpretation is that, although several other substances were used, most experiments were done with silver, gold or copper. In this case, (2^*) is perhaps the best choice. The third possible interpretation is that the three substance mentioned here are simply three examples, not necessarily the most important and not necessarily representative. If this is the intended meaning, (2^{**}) would be appropriate.

In (3), the relation between the techniques used in “[5–8]” and the two mentioned specifically is ambiguous. One interpretation of this sentence is that phase-averaging and time-averaging techniques are referred to explicitly because they are representative of all the techniques that can be applied. In this case, something like (3) would perhaps be best. The second interpretation is simply that these two are the most important techniques (or most interesting from the author’s point of view). In this case, (3^*) is a good choice.

Example (4) seems to be implying that the most interesting cases are those of large-scale flow, although this is not entirely clear. The rewritten version makes this point more explicit.

Chapter 12

any

The word *any* (acting as an adjective or pronoun) is often used incorrectly. Here I treat three particularly problematic types of misuse.

12.1 Problems with negative expressions

12.1.1 Modifying the subject

A negative sentence (i.e. a sentence with a negative predicate) should never have a subject that is modified by *any*. The situation here is similar to that involving *all* and *both* discussed in Chapter 8 and *each* and *every* discussed in Chapter 52, but in the present case, the resulting problem is usually not one of ambiguity but rather of mismatched meaning.[1]

Consider the following.

> (1) Though a multi-pronged string is thought to exist in type II string theory, any corresponding supergravity solution has not been found yet.
> (1) Though a multi-pronged string is thought to exist in type IIB string theory, no corresponding supergravity solution has yet been found.
> (2) This relation implies that any two of the $n+1$ gradient vectors do not vanish simultaneously at any point.
> (2) This relation implies that no two of the $n+1$ gradient vectors vanish simultaneously at any point.
> (3) In this case, any solution to the E-term conditions will not be realized as a vacuum configuration of the model.
> (3) In this case, no solution to the E-term conditions will be realized as a vacuum configuration of the model.

Logically, the original sentences above are quite strange. In each of these, the meaning is expressed as *[(arbitrary) noun] + [negative verb]*.[2] However, this is

[1] We should note that there is also a grammatical difference here. Whereas the constructions */all/each/every/ + [subject] + [negative predicate]* are grammatically possible (although often ambiguous), *any + [subject] + [negative predicate]* is considered erroneous.

[2] The nouns here ("solution," "two," and "solution") are the subjects of the verbs ("has not been found," "do not vanish" and "will not be realized") of the clauses in which they appear.

merely an unnatural way of stating *no [noun] + [affirmative verb]*. This problem of logic results from a problem of grammar, and therefore perhaps it is best to simply remember that a subject modified by *any* cannot be used with a negative predicate.

12.1.2 Acting as the subject

Logically, the situation in which the pronoun *any* acts as the subject of a negative predicate is the same as that discussed above. The example below demonstrates this erroneous construction.

> (4) However, it should be stressed that in this case any of these schemes is not sufficient.
> (4) However, it should be stressed that in this case none of these schemes is sufficient.

In (4), "any" is the subject of "is."

12.1.3 Other problems

The examples presented above illustrate the most common and most serious problem involved with the use of *any* in negative expressions. Here we consider three different types of problems.

Acting as an adjective

> (5) But note that in (3.3) there is not any mass term.
> (5) But note that in (3.3) there is no mass term.
> (6) This situation is addressed by the Boltzmann-Jeans conjecture [2] regarding slow relaxation in Hamiltonian systems without any contact to a heat bath.
> (6) This situation is addressed by the Boltzmann-Jeans conjecture [18] regarding slow relaxation in Hamiltonian systems with no contact to a heat bath.
> (6*) This situation is addressed by the Boltzmann-Jeans conjecture [18] regarding slow relaxation in Hamiltonian systems in the absence of a heat bath.

The originals here are not incorrect in any sense, but they are poor stylistically. As these examples demonstrate, in most situations, the logical construction *[negative expression] + [(arbitrary) noun]* (where, here, the "arbitrary" meaning is expressed by *any*) is best replaced by *[affirmative expression] + no + [noun]*. In the above, the negative expressions are "is not" and "without," and the corresponding affirmative expressions are "is" and "with." Note that the situation here regarding logical structure is quite similar to that discussed in Section 1.1.

Acting as an adverb

> (7) This value is not any longer smaller than ρ_0.
> (7) This value is no longer smaller than ρ_0.

(8) The first method is not any simpler than the second.
(8) The first method is no simpler than the second.

Again, the originals here cannot be considered incorrect, but the rewritten versions are stylistically much better.

Acting as a noun

(9) Under less extreme conditions, this process produces many descendants, but in the present case it produces not any.
(9) Under less extreme conditions, this process produces many descendants, but in the present case it produces none.

The situation here is similar to those above.

As (5), (7), (8) and (9) illustrate, usually, when *any* is used as either an adjective or an adverb, the expression *not any* is best replaced by *no*, and when *any* is used as a noun, *not any* is best replaced by *none*.

12.2 Misuse with plural nouns

Although there are exceptional situations, usually *any* cannot be used to modify a plural noun. This is due to the fact that, unlike *all*, which refers simultaneously to every member of some group, *any* refers to a single, arbitrary member. Consider the following.

(1) However, it is generally difficult to calculate the elastic constants for any lattices.
(2) Of course, many different decision algorithms can be created for any maps from $R^m_+ \times R^n_+$ onto R.
(3) In any cases, we have a parameter region for which there exist isocurvature fluctuations.
(4) The position of this attractor can be changed significantly by almost any small perturbations.
(5) Since any such functions can be embedded in the dotted area, it is possible to have a case with $|g'(x)| > 1$.

In each case here, the noun modified by "any" should be made singular. In (3) and (5), it would also be possible to keep this noun plural and change "any" to *all*.

There is one situation in which the use of *any* with a plural noun is possible. To see this, let us focus on (5). Suppose the situation under study were such that, for example, the functions embedded in the dotted area always appeared in multiple-element sets. In this case "such functions" would refer to the elements of an arbitrary such set. However, even in this situation, although (5) would be possible, the intended meaning would be better expressed as *Since any such set of functions...* In this sentence, "any" modifies the singular noun "set."

12.3 Other inappropriate use

Sometimes I find *any* used when some other word (or no word at all) is more appropriate. The following are typical examples.

> (1) We employ the lowest-order derivative expansion, in which we discard any terms of the form $F_{\mu\nu}u^n$, where $n \in I$.
> (1) We employ the lowest-order derivative expansion, in which we discard all terms of the form $F_{\mu\nu}u^n$, where $n \in I$.
> (2) We replace the derivative ∂_μ by the covariant derivative $\partial_\mu + \omega_\mu$ and keep any other part unchanged.
> (2) We replace the derivative ∂_μ by the covariant derivative $\partial_\mu + \omega_\mu$ and keep all other parts unchanged.
> (3) In newborn rabbits, activated lymphocytes are retained even when the rabbits are isolated from any antigen.
> (3) In newborn rabbits, activated lymphocytes are retained even when the rabbits are isolated from all antigens.
> (4) The value of $W_{i,j}$ is unchanged at $t = n + 1$, unless player i obtains any quantity of C_j at $t = n$.
> (4) The value of $W_{i,j}$ is unchanged at $t = n + 1$, unless player i obtains some quantity of C_j at $t = n$.
> (5) In fact, any interaction vertex shown in Fig. 3 has the following properties:
> (5) In fact, each interaction vertex shown in Fig. 3 has the following properties:
> (6) In Appendix 2, we estimate p_1 and $\dot{E}$ in more detail for any values of γ and P.
> (6) In Appendix 2, we give a more detailed estimate of p_1 and $\dot{E}$ for arbitrary values of γ and P.
> (7) It is convenient to rewrite any traceless symmetric tensor $X_{\mu\nu}$ in terms of such X^λ.
> (7) It is convenient to rewrite traceless symmetric tensors $X_{\mu\nu}$ in terms of such X^λ.

The main problem with the original sentences here is that the meaning of arbitrariness imparted by "any" to the noun it modifies is inappropriate.

Chapter 13

anymore

The adverb *anymore* should be avoided in formal writing. This word is often used with mistaken meaning, and even when it is used in a semantically correct manner, it is generally too informal for scholarly works.[1]

13.1 Superfluous use

Anymore can be used in negative sentences when expressing the idea that some state or condition has changed.[2] However, it is often mistakenly used in sentences in which this idea of change is lacking. The following are typical mistakes.[3]

(1) The resulting extended RE model is not equivalent to the LE model anymore.
(1) The resulting extended RE model is not equivalent to the LE model.
(2) The distribution e^{-S} is not normalizable and therefore does not belong anymore to the spectrum of the Fokker-Planck operator.
(2) The distribution e^{-S} is not normalizable and therefore does not belong to the spectrum of the Fokker-Planck operator.
(3) The resulting interaction matrix b_{ij} cannot be parameterized anymore using our definition of the random interaction.
(3) The resulting interaction matrix b_{ij} cannot be parameterized using our definition of the random interaction.
(4) In the random phase, all σ-branches are broken, and no TS with length greater than $\sim N^{1/2}$ exists anymore.
(4) In the random phase, all σ-branches are broken, and no TS with length greater than $\sim N^{1/2}$ exists.
(5) Under the latter condition, no flat pieces remain anymore.
(5) Under the latter condition, no flat pieces exist.

[1] For the most part, the discussion given here also applies to the term *any longer*, which is synonymous with *anymore*. However, this term is somewhat less informal than *anymore*.

[2] For example, we can say *These terms do not cancel anymore.* However, in formal writing, this is better stated *These terms no longer cancel.*

[3] The problem of superfluous use here is related to that of *already* (Chapter 10) and *yet* (Chapter 133).

(6) This result suggests that the local enhancing mechanism is not effective anymore beyond $\beta = 30$.
(6) This result suggests that the local enhancing mechanism is not effective beyond $\beta = 30$.

Note that in each of the original sentences here, the statement does **not** describe something that has changed, and thus "anymore" appearing in each is inappropriate. For example, let us consider (1). Here, although there is some implied change – evidently from the original RE model to the extended RE model – the assertion does not concern something that has undergone this change. Rather, it concerns the "resulting extended RE model," which, instead of experiencing change itself, is the result of the change. Contrast this with the following sentence: *As a result of this change, the RE model is not equivalent to the LE model anymore.* Here, because the statement is with regard to the RE model, which indeed does undergo the change in question (from a state of equivalence to the LE model to one of non-equivalence), this use of "anymore" is appropriate. However, this sentence is somewhat informal, and it would better be written as follows.

(7) As a result of this change, the RE model is no longer equivalent to the LE model.

The following sentences, which clearly describe things that have undergone change, should be contrasted with (3)–(6).

(8) With this change, the interaction matrix b_{ij} can no longer be parameterized using our definition of the random interaction.
(9) When the system undergoes a transition to the random phase, all σ-branches are broken, and no TS with length greater than $\sim N^{1/2}$ remains.
(10) When the latter condition comes to be realized, no flat pieces remain.
(11) This fact suggests that when β increases beyond 30, the local enhancing mechanism is no longer effective.

In contrast to (3), which regards a matrix b_{ij} that results from change, (8) is a statement about a matrix that itself has changed. While (4) concerns a system that is in the random phase, (9) concerns a system that makes a transition to this phase. Whereas (5) makes an assertion about the situation under some condition, (10) makes an assertion about the change undergone when this condition is realized. Quite similarly, (6) regards the circumstances in some parameter region, while (11) regards the change in the circumstances taking place when this parameter region is entered. In each of the situations described by (8)–(11), *anymore* could be used to express the intended meaning, but the resulting sentence would be inappropriately informal for scholarly writing.

13.2 Informal use

The following exemplify uses of *anymore* that, while not incorrect, are stylistically poor. The rewritten versions demonstrate some alternative ways to express the same

types of meaning.

(1) This case is thoroughly treated in the textbook by Sigmund, and therefore there is no need for us to discuss it anymore.
(1) This case is thoroughly treated in the textbook by Sigmund, and therefore there is no need for us to discuss it further.
(2) Although $\overline{F}_{\mu\nu}\widetilde{\overline{F}}_{\mu\nu}$ cannot be expressed by the total divergence anymore, its form does not become significantly more complicated.
(2) Although $\overline{F}_{\mu\nu}\widetilde{\overline{F}}_{\mu\nu}$ can no longer be expressed by the total divergence, its form does not become significantly more complicated.
(3) As is well known, the gauge invariance does not hold anymore after the momentum cutoff is carried out.
(3) As is well known, the gauge invariance no longer holds after the momentum cutoff is carried out.
(4) If the stationarity is broken, this solution is not symmetric anymore.
(4) If the stationarity is broken, this solution is no longer symmetric.

13.3 Misuse of *any more*

Occasionally, I find the expression *any more* used in place of *anymore*. This is simply wrong. In addition to the fact that these expressions have different meanings, they are grammatically different parts of speech; *any more* is an adjective, and *anymore* is an adverb. Compare the following.

(1) I do not want pie anymore.
(2) I do not want any more pie.

In (1), “anymore” modifies the verb “want,” and in (2), “any more” modifies the noun “pie.” Although the meanings of these sentences are similar, they are certainly not identical: (1) is about the change undergone by the speaker, from wanting pie to not wanting pie, while (2) is simply about the speaker’s present state of not wanting more pie. Also, whereas (2) implies that the speaker has already had pie, (1) does not.

Chapter 14

around

I often find *around* (acting as an adverb or preposition) used when something else would be more appropriate. In general, the problem created by *around* is that because it has many meanings, its use often results in imprecise statements.[1]

14.1 Misused with a meaning close to *near*

Most commonly, *around* is misused with a meaning close to that of *near*. The following illustrate this problem.

(1) The SCIFI target provides an image of charged particle tracks around the (K^-, K^+) reaction vertex.
(2) Figure 1 displays the emission spectra of the CuCl nanocrystals around the Z_3 exciton band at 77K.
(3) The resonant emission is sharply enhanced when $2h\nu_{ex}$ falls inside the inhomogeneously broadened Z_3 absorption band (around 3.23 eV).
(4) Polymer lipids gather in the strongly deformed region from neighboring regions until no polymer lipids remain around the localized deformations.
(5) Figure 2 shows how the width W of the hill around $\gamma = 0$ depends on K^{-1}.
(6) The statistical average F is insensitive to the value of a around g_p.
(7) These points fall around the defect.

The problem with "around" in these sentences is that in each case it could be interpreted as a synonym of several of the following: *near*, *approximately at*, *on /both/all/ sides of*, *on either side of*, *in the /neighborhood/region/vicinity/ of*, *surrounding*, *in the region surrounding*, *throughout the region surrounding*, *encircling*, *centered at*. While these expressions are all similar in meaning, they are obviously not identical, and for this reason, the above sentences are somewhat imprecise. It appears that the most natural interpretations can be expressed by

[1] It is important to keep in mind that usually, *around...* is **not** the most appropriate word to express meanings similar ... に近い.

changing "around" as follows: in (1), to *near*, *approximately at* or *in the /neighborhood/region/vicinity/ of*; in (2), to *near*, *on both sides of* or *in the /neighborhood/region/vicinity/ of*; in (3), to *near* or *approximately at*; in (4), to *near*, *in the /neighborhood/region/vicinity/ of* or *surrounding*; in (5), to *near*, *approximately at*, *on either side of*, *in the /neighborhood/region/vicinity/ of* or *centered at*; in (6), to *near* or *in the /neighborhood/region/vicinity/ of*; in (7), to *near*, *on all sides of*, *in the /neighborhood/region/vicinity/ of*, *in the region surrounding*, or *throughout the region surrounding*.

14.2 Further examples

Here I present some additional typical examples of the misuse of *around*. In some of these sentences, it is not obvious what the most appropriate expression is, but in each case I have tried to make what seems to be the most natural choice.

(1) s approaches around 5/3.
(1) s approaches a value near 5/3.
(2) We estimate this value to be around 1.2.
(2) We estimate this value to be approximately 1.2.
(3) Compared with the one-loop analysis of the Higgs boson mass in Refs. [4-6], two-loop effects decrease each value by around 6 GeV.
(3) Two-loop effects decrease each value of the Higgs boson mass by approximately 6 GeV in comparison with the values obtained in the one-loop analysis of Refs. [4-6].
(4) Enhanced production of $\Lambda\Lambda$ pairs is observed near the threshold (around the masses of 3.2–4.1 GeV/c^2).
(4) Enhanced production of $\Lambda\Lambda$ pairs is observed near the threshold (for masses in the range 3.2–4.1 GeV/c^2).
(5) For all the nuclear targets, the K^+ momentum spectra are characterized by a large bump centered around $p_{K^+} \simeq 0.6$ GeV/c.
(5) For each nuclear target, the K^+ momentum spectrum is characterized by a large bump centered at a point near $p_{K^+} = 0.6$ GeV/c.
(5*) The K^+ momentum spectra for all the nuclear targets are characterized by large bumps centered at points near $p_{K^+} = 0.6$ GeV/c.
(6) A broad emission band appears around 3.23 eV.
(6) A broad emission band appears /approximately at/in the vicinity of/on either side of/ 3.23 eV.
(7) In the case that the valence particles are filled from the z axis to $\mu = \sin(\theta)$, the Fermi surface lies around $\mu = \sin(\theta)$.
(7) In the case that the valence particles are filled from the z axis to $\mu = \sin(\theta)$, the Fermi surface lies approximately at $\mu = \sin(\theta)$.
(8) The pointed Hausdorff limit, $\lim_{y\to 0}(1/yX, x)$, of the $1/y$-scaling of the metric around x is the flat cone discussed above.
(8) The pointed Hausdorff limit, $\lim_{y\to 0}(1/yX, x)$, of the $1/y$-scaling of the metric in the neighborhood of x is the flat cone discussed above.
(9) We combine the bordering algorithm with the inclusion method to

obtain the desired results around the turning point.
(9) We combine the bordering algorithm with the inclusion method to obtain the desired results on either side of the turning point.
(10) In Fig. 1 we show the σ^2 map which was searched for around the σ^2 minimum.
(10) In Fig. 1 we show the σ^2 map that was searched for on each side of the σ^2 minimum.
(11) We specifically investigate the parameter dependence of F around the valleys of Ψ.
(11) We specifically investigate the parameter dependence of F /in/near/ the valleys of Ψ.

Chapter 15

as a result and *consequently*

The synonymous adverbial expressions *as a result* and *consequently*[1] are often used illogically. These expressions should only be used when the situation described in the sentence or clause they introduce follows in a causal manner from that described in the sentence or clause appearing before them. The examples considered in the following sections illustrate their typical misuse in situations that such a relationship does not exist.[2]

15.1 Misused in mathematical and theoretical assertions

Often, *as a result* and *consequently* are misused in the situation that some condition, relation or result is implied by a theory or follows logically from a theorem, mathematical relation, or some other type of mathematical or theoretical assertion. The problem with this type of usage is that *as a result* and *consequently* express causal relationships, not logical relationships. The following examples are illustrative.

> (1) As a result of the replica theory, these order parameters satisfy the following equations.
> (1) As /demonstrated by/we know from/asserted by/can be shown using/predicted by/ the replica theory, these order parameters satisfy the following equations.
> (2) The multipole moments of the potential are equal to those of the nuclear density as a result of Theorem 2.3.
> (2) The multipole moments of the potential are equal to those of the nuclear density, as /can be shown using/follows directly from/can be seen from/demonstrated by/ Theorem 2.3.
> (3) As a result of (2.2), we can choose a set of independent operators

[1] Of course there are other expressions to which the discussion of this chapter applies, including *as a consequence* and *in consequence*, but their misuse is rare compared to that of *as a result* and *consequently*.

[2] Many of the problematic uses of *as a result* and *consequently* treated in this chapter appear to result from the inappropriate translation of 帰結 as *result* or *consequence* or of 従って or それゆえに as *as a result* or *consequently*. There are two points to note here. First, although 帰結 can be used as a synonym of 結論, *result* and *consequence* cannot be used as synonyms of *conclusion*. Second, usually, 従って and それゆえに cannot be translated as *as a result* or *as a consequence*.

that allow for the relation $p \sim r^{\alpha}$ to be satisfied in the $\theta \to \theta_0$ limit.
(3) If follows from (2.2) that we can choose a set of independent operators that allow for the relation $p \sim r^{\alpha}$ to be satisfied in the $\theta \to \theta_0$ limit.
(4) As a result of Eq. (9.12), Eqs. (10.1), (10.2) and (10.3) are regarded as constraint equations to be solved.
(4) Considering Eq. (9.12), it is seen that Eqs. (10.1), (10.2) and (10.3) should be regarded as constraint equations to be solved.
(5) The set of all sequences p has a bijection to the set of all mappings Σ such that $|\Sigma^{-1}(i)| = n_i = m_i - m_{i+1}$ for $i \in [0, \epsilon]$. As a result, we obtain a bijection between $\mathcal{F}(\mu)$ and the set of such mappings Σ.
(5) ...Thus there exists a bijection between $\mathcal{F}(\mu)$ and the set of such mappings Σ.
(6) If quantum gravity has an IR Gaussian fixed point, the RG flows would converge to it. As a result, IR effective theories are described by finite couplings and are renormalizable.
(6) .../We could thus conclude that/It would follow that/ IR effective theories can be described by finite couplings and are renormalizable.
(6*) ...For this reason, IR effective theories could be described by finite couplings and would be renormalizable.
(7) The TY invariance is recovered in the background spaces. As a result, the projected RG flows in the background spaces are regarded as TY invariant.
(7) ...Therefore the projected RG flows in the background spaces can be regarded as TY invariant.
(8) An I-network can be reconfigured to form a number of different functional circuits. As a result, an I-network can produce a wide range of patterns.
(8) ...For this reason, an I-network can produce a wide range of patterns.
(9) Here J_0 is a Bessel function of order 0. Consequently the commutator $[B_x, B_y]$ is obtained unambiguously by differentiating $iH(x-y)$ with respect to ∂_x and ∂_y.
(9) .../For this reason/Therefore/Hence/, the commutator $[B_x, B_y]$ is obtained unambiguously by differentiating $iH(x-y)$ with respect to ∂_x and ∂_y.

The problems in all of the original sentences here are similar. Let us consider (1). This sentence seems to imply that the existence of the replica theory is the reason that the parameters in question satisfy the “following equations.” In other words, if this theory did not exist, these parameters would not satisfy the equations. Of course, this is nonsense. The actual relationship between the replica theory and the fact that “these parameters” satisfy “the following equations” is of a logical nature, not a causal nature, as expressed by the original. This logical relationship is made clear by (1).

It is important to note that the problem with the presently considered use of *as a result* and *consequently* is not simply that the discussion is of a mathematical or theoretical nature. The error here is that although *as a result* and *consequently*

can express only causal connections, they are being used in the original sentences to express logical connections. Note that in each of the original sentences above, some behavior is said to follow "as a result" or "in consequence" of a mathematical or theoretical assertion. The implication is that the behavior of the system in question is affected by the assertions that people make or have made about it.

Although the uses of *as a result* and *consequently* demonstrated above are illogical, there certainly are many situations within mathematical and theoretical contexts in which they can be used. For example, consider the sentence below.

> (10) When the pulse impinges upon the boundary region, it begins to exhibit oscillation in accordance with (3.7). As a result, the propagation velocity begins to decrease.

In this example, the connection expressed by "as a result" is indeed of a causal nature. Here, the *behavior* of the pulse beginning to oscillate causes the *behavior* of its velocity beginning to decrease. The following are similar.

> (11) If d reaches the critical thickness d_c, the thickness of the bulk layer becomes comparable to the characteristic length scale of the α process, and, as a result, the dynamics change drastically.
> (12) As a result of this interplay between two types of information, the higher level dynamics emerge.
> (13) The concentration of each chemical species decreases as a result of an increase in the volume of the cell.
> (14) As a result of the coalescence, either a rotating cluster or a black hole is formed.
> (15) If the instability is sufficiently strong, many chaotic modes appear, and consequently the system evolves toward a turbulent state.
> (16) In the present model, the second term vanishes in the $\gamma \to \infty$ limit. Consequently, in this limit, the behavior of the network is described by the following equations:

15.2 Other problems

The examples below demonstrate other types of illogical use of *as a result* and *consequently*.

> (1) We demonstrate that their masses are also independent of σ_0. As a result, in the $k > 0$ scenario, we can adjust M freely to obtain the desired result.
> (1) ...It is thus found that in the $k > 0$ scenario, we can adjust M freely to obtain the desired result.
> (2) We find that $t < t_0$. As a result, it is possible that behavior described by the theory is fundamentally unobservable.
> (2) ...This implies that the behavior described by the theory may be fundamentally unobservable.
> (3) We proposed in a preceding study to examine the consistency of

these methods in three different contexts. As a result, the assumption regarding the transient made in the simpler method leads to significant inconsistencies in almost all cases of physical interest.
(3) ...Carrying out this examination, we have found that the assumption regarding the transient made in the simpler method leads to significant inconsistencies in almost all cases of physical interest.
(4) This approach gives only trivial results. As a result, we considered a modified form.
(4) ...For this reason we considered a modified form.
(5) The results of the two methods of calculation are thus found to be inconsistent. The former method is well established, consequently, the latter is wrong.
(5) ...Then, because the former method is well established, it would appear that the result obtained from the latter is wrong.
(6) Numerical simulations show that the noise distribution does not remain Gaussian if the network fails to recall the pattern. Consequently, our theory cannot be applied to the dynamical process after a failure to recall.
(6) ...This result implies that our theory cannot be applied to the dynamical process after such a failure.
(6*) ...For this reason we conclude that our theory cannot be applied to the dynamical process after such a failure.

The implication of (1) is that the fact that M can be adjusted freely is due to our demonstration that the masses are independent of σ_0. Obviously, however, this cannot be true, as our demonstration of this independence does not change the situation regarding M. It merely makes this situation known to us. This meaning is expressed by (1). Example (2) asserts that our derivation of the relation $t < t_0$ exerts some influence on the nature of the theory under investigation. However, because the situation described by this sentence is not that in which this relation is used to alter this theory but, rather, that in which it is simply derived as a characterization of it, the meaning expressed here is illogical. The meaning of (3) is that this "proposal" caused the assumption in question to lead to inconsistencies. The connotation of (4) is that "our" behavior is directly determined by the results of the approach under consideration. The problem with (5) is that it incorrectly asserts that the established nature of the "former method" causes the "latter method" to be wrong.[3] The statement in (6) misidentifies the numerical result as the cause of the inapplicability of the theory. In fact, (given that the numerical computation and theory themselves are 'sound') this result and this inapplicability have a single origin, the nature of the model under study.

[3]Note that there is also a grammatical problem here. Because "consequently the latter is wrong" is an independent clause, the adverb "consequently" is being misused as a conjunction.

Chapter 16

as a result vs. *as the result*

The prepositional phrases *as a result* and *as the result* are similar but not identical in meaning. The former is usually used in reference to a resulting situation, while the latter is usually used in reference to something that takes a more concrete form (e.g., a mathematical expression). This difference is due to the difference in meaning of the definite and indefinite articles: *the* implies that the result in question is *unique*, while *a* implies that it is not. In general, *as the result* is more appropriate when the result is an unambiguously specifiable entity than when it is something of a qualitative, intangible nature. This is because things of the latter type are often difficult to define, and something that cannot be clearly defined usually cannot be characterized as unique. For example, consider the following.

> (1) As a result of our investigation, we can intuitively understand the behavior near the two point sources.

Here, "result" refers to the situation that we now possess this intuitive understanding. In this case, *as the result* would be quite unnatural, because a situation generally cannot be regarded as a well-defined entity. As this example illustrates, *as a result of* can often be replaced by *owing to* or *in consequence of* without changing the overall meaning.

Note that in (1), the "result" in question does not appear explicitly in the sentence but, rather, is described by it. This is generally the case when using *as a result*. By contrast, with *as the result*, the result under consideration usually does appear explicitly, as demonstrated below.

> (2) We thus obtain the relation $g = \frac{a^2}{3}$ as the result of our analysis.

Here, "result" refers to the relation "$g = \frac{a^2}{3}$." As demonstrated by this example, when used in the phrase *as the result*, "result" represents some clearly defined quantity, expression, data, etc. If we changed "the" to *a* in (2), the resulting sentence would be somewhat unnatural. In this case, "result" would somehow seem to refer to our *obtaining* the relation rather than the relation itself. (In the case that there are several concrete results of which $g = \frac{a^2}{3}$ is one, it would be better to describe the situation as follows: *We thus obtain the relation $g = \frac{a^2}{3}$ as one result of our analysis.*) As this example illustrates, *as the result of* can usually be replaced by

constituting the result of or *representing the result of* without changing the substance of the sentence.

As mentioned above, in their most natural usages, *as a result of* is synonymous with *owing to* and *in consequence of*, while *as the result of* is synonymous with *constituting the result of* and *representing the result of*. To obtain a better understanding of the present topic, it is worth giving some thought to these synonymous phrases. First, it is clear that *owing to* and *in consequence of*, like *as a result of*, would be inappropriate in (2), because they would impart a very unnatural causal meaning – that the analysis itself created the situation in which "we" have the relation "$g = \frac{a^2}{3}$." (Note that, in contrast to (2), the causal relationship expressed in (1) is correct: There, "our investigation" does indeed create the situation in which "we" have this intuitive understanding.) Conversely, *constituting the result of* and *representing the result of*, like *as the result of*, would be inappropriate in (1), because that which constitutes or represents the result does not itself appear.

The most common error resulting from the confusion of these expressions is that in which *as the result* is misused for *as a result*. The following examples are typical.

> (3) Due to the entropic effect, the polymer tends to occupy a large volume and moves to the curved region of the membrane. As the result, the flat membrane becomes unstable.
>
> (4) Here, $h \equiv 0$ is no longer a solution of (4.3), and the second solution is selected. As the result, the solutions of (4.4) and (4.5) differ only by an additive constant.

In both of these sentences, "as the result" should be changed to *as a result*. Note that in each case, the result under consideration is a situation – that in which the flat membrane is unstable and that in which "the solutions (4.4) and (4.5)" differ by only an additive constant.

Chapter 17

as for

Use of introductory phrases beginning with the preposition *as for* should be avoided. In almost all cases that I find such phrases, either they are completely unnecessary, or they can be replaced by something clearer and more concise.

17.1 Introduction

A prepositional phrase of the form *as for + [noun]* somewhat vaguely expresses the idea that this *[noun]* represents the context within which or with regard to which the following statement is made. However, in most situations that I find such a prepositional phrase used, the context is already clear, and therefore this phrase is superfluous. In other situations, I find *as for* inappropriately used in place of *for* or *in*, which can also in some sense specify a context.

The expression *as for* is close in meaning to *with regard to*, *in regard to*, *as regards*, *regarding*, *with respect to* and *concerning*, which are all similar but differ slightly in nuance and usage. However, when the intended meaning is something of this nature, because *as for* is more vague than the latter expressions, and because it has a second, unrelated usage,[1] in formal writing it is usually better to avoid *as for* in favor of one of these expressions.

17.2 Superfluous use

17.2.1 Discussion

The most common misuse of *as for* is illustrated below.

> (1) As for the interval σ_α, it converges to the point p_0 as α approaches α_0.

I find this type of construction used very often by Japanese writers. It seems to be a direct translation of the common Japanese construction in which a sentence begins with a topic, followed by については, について言えば, においては, に関しては, or simply は (which corresponds to *as for*), and then continues to the main

[1] It can also act as an adverb with the meaning *in the same way as in the case of.*

assertion made with regard to this topic. For example, the above seems to be a direct translation of something like one of the following.

· 区間 σ_α は、α が α_0 に近づくに従って、点 p_0 に収束する。
· 区間 σ_α については、α が α_0 に近づくに従って、点 p_0 に収束する。
· 区間 σ_α について言えば、α が α_0 に近づくに従って、点 p_0 に収束する。

This type of construction is used much less commonly in English, because it usually results in unnecessarily convoluted and verbose expressions.[2] This point can be understood by considering the following rewritten form of (1).

(1) The interval σ_α converges to the point p_0 as α approaches α_0.

This sentence is grammatically much simpler than the original, while it conveys the same meaning.

Before studying the misuses of *as for* in detail, it should be pointed out that there are situations in which its use in constructions like that above, although perhaps not optimal, is at least acceptable. For example, suppose that (1) appeared after the discussion of certain other intervals and their behavior. In this case, the role of "as for" would be to indicate that the topic of discussion is changing. It also would carry a meaning of contrast, indicating that the situation regarding this interval is different from that regarding the previously considered intervals. If this were indeed the intention, then this use of "as for" would not be inappropriate. (Note that this use of *as for* corresponds more closely to the Japanese 一方... については than to simply については.) However, even in such a situation, there are better alternatives, as illustrated by the following.

(1′) /Contrastingly/By contrast/, the interval σ_α converges to the point p_0 as α approaches α_0.
(1′*) The interval σ_α, /contrastingly/by contrast/, converges to the point p_0 as α approaches α_0.
(1′**) In contrast to the intervals discussed above, the interval σ_α converges to the point p_0 as α approaches α_0.
(1′***) The interval σ_α behaves much differently than the intervals discussed above, converging to the point p_0 as α approaches α_0.

These sentences more clearly express the idea that the situation regarding σ_α is different.

17.2.2 Examples

Below I give a number of examples. In each of these "as for" adds no meaning. Its use only results in unnecessarily wordy and extremely awkward sentences.

(2) As for the analyzing power, it begins to deviate significantly from the experimental value near 192 MeV.

[2] In particular, it usually requires the object of the preposition *as for* to be repeated (in the form of a pronoun) in the main clause.

(2) The analyzing power begins to deviate significantly from the experimental value near 192 MeV.
(3) As for the specific heat, we have defined it for constant chemical potential.
(3) We have defined the specific heat for constant chemical potential.
(4) As for the dynamics of the center of mass, these dynamics are clearly described by Eq. (4.4).
(4) The dynamics of the center of mass are clearly described by Eq. (4.4).
(5) It is thus seen that the model indeed predicts the existence of this family of particles and accounts for many of their experimentally observed properties. As for the masses of the particles, however, the predicted values are well outside of the experimentally observed ranges.
(5) ...However, the predicted masses are well outside of the experimentally observed range.
(6) The above changes of the quantities χ_i leave the symmetry of the solution intact to $O(\epsilon^3)$. As for the energy, they result in a change of $O(\epsilon)$ to the internal energy of the U_1–U_2 subsystem and a change of $O(\epsilon^2)$ to the rest of the system.
(6) The above changes of the quantities χ_i leave the symmetry of the solution intact to $O(\epsilon^3)$, while they cause a change in the internal energy of the U_1–U_2 subsystem of $O(\epsilon)$ and the rest of the system of $O(\epsilon^2)$.
(7) As for $v_{\rm pp}$, most existing calculations of it employ bare interactions.
(7) Most existing calculations of $v_{\rm pp}$ employ bare interactions.

17.3 Misused as a synonym of *with regard to*, *concerning* and similar expressions

Although when used as a preposition, *as for* is close in meaning to *with regard to*, in formal written work, for the reasons discussed in Section 1, the latter (or one of the other expressions listed there) should be used instead. The following are typical examples.

(1) As for the mesoscopic β cycle, Malevich makes several interesting conjectures and claims to have shown that $\beta > 0$ is not a sufficiently strong condition for reversibility in general.
(1) With regard to the mesoscopic β cycle, Malevich makes several interesting conjectures and claims to have shown that $\beta > 0$ is not a sufficiently strong condition for reversibility in general.
(2) As for the physical meaning of the bilocal field, see Ref. [33].
(2) With regard to the physical meaning of the bilocal field, see Ref. [33].
(3) As for the first criticism raised by Hagemark, let us first note that it is indeed quite likely that the present model based on a mean field treatment is insufficient to describe certain important features of the system.
(3) Concerning the first criticism raised by Hagemark, let us first note that it is indeed quite likely that the present model based on a mean field treatment is insufficient to describe certain important features of

the system.
(4) As for the equilibrium state, the result of the present theory coincides with that of the replica theory.
(4) /As regards/For/With regard to/ the equilibrium state, the result of the present theory coincides with that of the replica theory.

In (1), the intended meaning of "as for" is unclear. Here, it merely expresses the idea that the context of the statement that follows is the mesoscopic β cycle. Thus, although we know that there is some relation between this cycle and Malevich's conjectures and claim, the nature of this relation is open to interpretation. The rewritten form, (1), clearly expresses that these conjectures and claim are *about* this cycle. Here, *in regard to* could be used with no change of meaning, while *concerning* and *regarding* are possible, but somewhat less appropriate. In this case, *as regards* and *with respect to* are inappropriate.

The use of "as for" in (2) is illogical, as it implies the absurdity that the content of the statement "see Ref. [33]" itself regards the physical meaning of the bilocal field. In this case, "with regard to" seems to be the best choice. Here, *as regards*, *regarding*, *in regard to*, *with respect to* and *concerning* all seem, to varying degrees, inappropriate.

Again in (3), "as for" is quite unnatural. Here, (3) clearly expresses the idea that the statement about the mean field treatment addresses a criticism by Hagemark. In this sentence, *with regard to*, *regarding*, *in regard to* and *with respect to* are also possible, although "concerning" somehow seems most suitable.

The problem in (4) is not as serious as those in the previous examples, but here again the meaning expressed by "as for" is ambiguous. In this sentence "as regards," "with regard to" or "for" (acting as a synonym of *in the case of*) is probably most natural, although *in regard to* could also be used. The meanings imparted by these terms are sufficiently direct to convey the idea that this "result" is that of the equilibrium state. In this case, *with regard to*, *regarding*, *with respect to* and *concerning* express inappropriately indirect meanings. In particular, if one of these were used, it would be unclear whether the result under consideration is that of the equilibrium state.

17.4 Misused as a synonym of *for*

As for is often misused in place of *for* in situations illustrated by the following.

(1) As for reviews, see Refs. [3,4].
(1) For reviews, see Refs. [3,4].
(2) As for the calculational rules appropriate in the case of anomalies, see Eqs. (7.2)–(7.10).
(2) For the calculational rules appropriate in the case of anomalies, see Eqs. (7.2)–(7.10).
(3) As for the isothermal part of the cycle B→C→D→A→B, we assume quasi-static change of q.
(3) For the isothermal part of the cycle B→C→D→A→B, we assume

quasi-static change of q.

(4) As for the first type of reaction, more sophisticated calculations, including proper treatment of the N-$\bar{N}$ polarizations, are needed.

(4) For the first type of reaction, more sophisticated calculations, including proper treatment of the N-$\bar{N}$ polarizations, are needed.

The use of "as for" illustrated by (1) and (2) is not possible, as this preposition simply does not possess the meaning it is intended to express here. The implication of (2) is that Eqs. (7.2)–(7.10) are themselves the calculational rules. In the case that these do not constitute the rules themselves but, for example, only give information about these rules, it would be better to replace "for" with *regarding* or *with regard to*. In (3) and (4), "as for" is synonymous with *as in the case of*. Thus the meaning of (3) is that quasi-static change is assumed for the present case, as it was previously assumed for the cycle B→C→D→A→B, and the meaning of (4) is that more sophisticated calculations are needed in the present case, as they were needed for the first type of reaction. However, in fact the authors of these sentences did not wish to compare previous and present cases. Rather, their intentions were simply to assert that quasi-static change is assumed for the cycle B→C→D→A→B and that more sophisticated calculations are needed for the first type of reaction. These situations are clearly described by the rewritten versions.

17.5 Misused as a synonym of *in*

The prepositions *as for* and *in* are similar in the sense that they can both be used in expressions specifying the context within which a statement is made. However, despite this similarity, they cannot be used interchangeably in this way. In simple terms, their difference is that the former introduces the context *to which* the statement applies, while the latter introduces the context *within which* the statement applies. The following are some typical examples of the misuse of *as for* when the intended meaning would best be expressed by *in*.

(1) As for the anomaly matching, we first consider only terms proportional to U and later consider terms proportional to U^3.

(1) In the anomaly matching, we first consider only terms proportional to U and later consider terms proportional to U^3.

(2) As for the former solution, it is known that there appear ambiguities in some terms due to the renormalon singularities.

(2) In the former solution, it is known that there appear ambiguities in some terms due to the renormalon singularities.

(3) As for the works based on the T-duality itself, results have been obtained only for certain Nahm transformations.

(3) In works based on the T-duality itself, results have been obtained only for certain Nahm transformations.

In (1), the act of carrying out the anomaly matching is the context within which the procedure "we first...U^3" exists. This could be made more explicit by changing

"in" to something like *when carrying out*, but this is not necessary. In the second example, "in" is clearly the appropriate term, as these ambiguities are literally **in** the solution. The situation is even more obvious for (3).

Chapter 18

as long as vs. *as far as*

The phrase *as long as* means *on the condition that*, whereas *as far as* means *to the extent that.* The most common mistake involving these expressions is that in which the latter is used when the former is the correct choice.[1] Below I give examples of their correct usage, and while explaining these, I also consider how the meanings they convey would change if the two expressions were mistakenly interchanged.

18.1 *as long as*

This expression is used in reference to conditions that can only be either completely satisfied or completely unsatisfied. The concept of degree is absent. The following demonstrates its correct usage.

> (1) This assumption is valid as long as $\alpha < \alpha_c$.

If we were to replace "as long as" with *as far as* here, the implication of the resulting sentence would be that the relation "$\alpha < \alpha_c$" can be satisfied to varying degrees. In this case, perhaps the interpretation would be that the assumption in question becomes more valid as the difference between α and α_c increases, but if this were indeed the intended meaning, this type of expression would be quite unnatural and in fact a misuse of the mathematical expression "$\alpha < \alpha_c$."

Next, let us consider the sentence below.

> (2) As long as we consider only behavior averaged over a sufficiently long time, we can ignore the effect of this perturbation.

Here, replacing "as long as" with *as far as* would yield a sentence whose implication is that to "consider only..." is something that can be done in different degrees. This, however, is incompatible with the word "only." If "only" were deleted, *as far as* would be possible, and the connotation would be that the effect of the perturbation becomes smaller as the time over which we average this behavior increases. However, if this were the intended meaning, it would be better expressed in this more direct manner.

The following provides a further example.

[1] It seems that perhaps the source of the confusion involving *as long as* and *as far as* is that in many cases, they can both be (correctly) translated as 限り.

> (3) These data are reliable as long as the temperature of the chamber does not exceed approximately 50 K.

Here, use of *as far as* would imply that exceeding 50 K is something that can be partially realized. Note that the resulting sentence could not be interpreted as meaning that the reliability of the data increases as the temperature of the chamber decreases. Although it could be understood as describing the situation in which the temperature is not uniform in the chamber and the reliability of the data depends on the portion of the chamber that exceeds 50 K, this would be a quite unnatural interpretation.

18.2 *as far as*

This phrase is used to express a relationship characterized by some variable degree or extent. The example below demonstrates one correct usage.

> (1) As far as our model is able to properly describe the behavior near the sink, it provides a good description of the behavior of the whole system.

Here, the implication is that the quality of the overall description provided by the model is determined essentially by the quality of the description near the sink: As the latter improves the former also improves. Thus in this case, the "properness" of the description near the sink is interpreted as a matter of degree. Here, we could replace "as far as" by *as long as*, but the import of the resulting sentence would be that we have some criterion to define what is meant by "properly describe the behavior near the sink" and that this criterion is either satisfied (completely) or not satisfied (completely).

Now, let us consider the following example.

> (2) As far as simple systems are considered, the essential difference between the predictions of the two models is small.

This sentence implies that the "simplicity" of the type of systems in question is understood as a matter of degree and that the agreement between the predictions of these models improves as the system under investigation becomes simpler. Again, we could use *as long as* here, but the connotation would then be that a system of the type in question is regarded as being either simple or not simple (that is, that we have some objective standard defining simpleness).

We end this chapter with the example below.

> (3) As far as we are interested in qualitative behavior, our model is quite useful.

The meaning of this sentence is that the model in question provides a good qualitative description of some physical phenomena, but not necessarily a good quantitative description. Further, it is implied that our interest can be to a varying degree in quantitative predictions, but the usefulness of the model decreases with the degree to which we are so interested. If we changed "as far as" to *as long as* here, the intimation would be that either we are interested in qualitative behavior or we are not. In fact, the resulting sentence would be quite natural.

Chapter 19

as well as

In this chapter, I consider misuse of the set expression *as well as*, which is synonymous with *in addition to* (when used as a preposition) and *and in addition* (when used as a conjunction). This phrase can also be used with the meanings of *in as /good/efficient/ a manner as* and *to the same /extent/degree/ as*. However, in this case, it is not a set expression but, rather, one example of the general pattern *as + [adjective/adverb] + as*. Because such usage rarely involves problems, I do not treat it here.

19.1 Misused as a synonym of *and* to connect nouns

I often find the expression *as well as* misused in place of *and*. To understand the misuse studied in this section, it is first necessary to realize that these terms do not express the same meaning, and when they are used to join two nouns, they even play grammatically different roles.

To understand the difference between *as well as* and *and*, let us compare the following sentences.

(1) Mathematicians and physicists have studied this problem.
(2) Mathematicians as well as physicists have studied this problem.

While these sentences are similar in meaning, there are several important differences. In (1), mathematicians and physicists are placed on an equal footing. Because *and* joins nouns in a symmetric way, the statement made here applies equally to mathematicians and physicists. The assertion is simply that that both groups have studied the problem. Grammatically, "and" is a conjunction that joins "mathematicians" and "physicists" to form a compound subject. Contrastingly, in (2) mathematicians and physicists are placed on unequal footings. This sentence is essentially a statement about mathematicians, and its primary assertion is that mathematicians have studied this problem. The phrase "as well as physicists" is only a comment, whose implication is that it is already understood (either from previous discussion or as a matter of general knowledge) that physicists have studied the problem. While it is not entirely clear, there is also the suggestion that physicists have studied the problem more or, at least, that this is generally considered to be the case. In this

sentence, grammatically, "as well as" is a preposition, and "physicists" is its object. In contrast to (1), the subject here is only "mathematicians."

To further understand the difference between *as well as* and *and*, let us compare the sentences below.

> (3) Mathematicians and physicists have studied this problem in different ways.
> (4) Mathematicians as well as physicists have studied this problem in different ways.

Although the meaning of (3) is somewhat ambiguous, its most natural interpretation is that mathematicians have studied this problem in one way and physicists have studied it in another. In contrast, because the basic statement in (4) is "mathematicians have studied this problem in different ways," this sentence cannot be interpreted in the same manner. The meaning here is that among both mathematicians and physicists there have been different ways of studying the problem. In this case, there is no implicit comparison between the methods of study employed by the two groups.

Now, consider the following.

> (5) The fast solution ψ_f as well as the slow solution ψ_s are insensitive to this type of perturbation.
> (5) The fast solution ψ_f, as well as the slow solution ψ_s, is insensitive to this type of perturbation.
> (5*) Both the fast solution ψ_f and the slow solution ψ_s are insensitive to this type of perturbation.

The first sentence here is grammatically incorrect, because the singular subject "ψ_f" does not match the plural verb "are." If this statement is meant to be about "ψ_f," with the situation regarding "ψ_s" already clear, then (1) is the correct choice. If, however, it is meant to be about both "ψ_f" and "ψ_s," then (1*) is appropriate.[1]

19.2 Other problematic use

In this section, I present examples illustrating some other typical types of problems involving the use of *as well as*.

19.2.1 Phrases appearing inside *[noun] + as well as + [noun]* construction

The examples below represents awkward usage of *as well as*.

[1]There are a number of other expressions (grammatically, acting as prepositions) that join nouns in such an asymmetric way, including *with*, *together with*, *along with*, *beside*, *besides* and *in addition to*. When one of these prepositions is used to join nouns, that (or those) appearing after it can act only as the object of this preposition. Therefore only the noun (or nouns) appearing before the preposition can play some other grammatical role, for example, that of the subject or object of the verb. This must be kept in mind when choosing the verb form.

(1) It is necessary to take kaons into account properly as well as hyperons.
(1) It is necessary to properly take into account kaons as well as hyperons.
(2) The production of double Λ hypernuclei in the (K^-, K^+) reaction on the emulsion nuclei was reported as well as those produced in the Ξ^- reaction.
(2) The production of double Λ hypernuclei in the (K^-, K^+) reaction with the emulsion nuclei, as well as that in the Ξ^- reaction, was reported.

In general, when used as a preposition, *as well as* should appear directly between the nouns (including modifiers) it is connecting.[2] In (1), the phrase "into account properly" appears within the *[noun] + as well as + [noun]* construction.[3] The main assertion of (1) is that it is necessary to properly take account of kaons. It is also implicit in this sentence that the necessity of properly taking account of hyperons was previously recognized. In (2), the two nouns joined by "as well as" are "production" and "that." Here, note that "of double Λ hypernuclei in the (K^-, K^+) reaction with the emulsion nuclei" modifies "production," and therefore it must appear before "as well as." (Also note here that "on the emulsion nuclei" in the original represents a very common misuse of the preposition *on*.)

19.2.2 Misused with *both*

Consider the following.

(3) Both the energy as well as the angular momentum are conserved.
(3) Both the energy and the angular momentum are conserved.
(3*) The energy as well as the angular momentum is conserved.

The use of "both" in the original implies that the energy and angular momentum are regarded on an equal footing. This is contradicted by the use of "as well as."

19.2.3 Misused to avoid repetition of *and*

The following demonstrates a particular type of problematic use in which *as well as* is used to connect nouns.

(4) Such experiments have been carried out on Newtonian fluid systems, homopolymer and copolymer systems, as well as gel systems.
(4) Such experiments have been carried out on Newtonian fluid systems, homopolymer and copolymer systems, and gel systems.
(4*) Such experiments have been carried out on Newtonian fluid systems and homopolymer and copolymer systems, as well as gel systems.

The first sentence is simply incorrect. One possible interpretation here is that "as well as" is being used in place of *and*. With this interpretation, it would appear that

[2] See (8*) for a particular type of exception to this rule.

[3] Grammatically, the prepositional phrase "into account" here is an adverbial, modifying the verb "take." Then, "properly" is an adverb modifying the set "take...into account." Because "take" and "into account" function as a set (or, more precisely, because "properly" modifies them as a set here), it is best to avoid splitting them. This is another reason why (1) is better than (1).

the author wished to avoid using *and* because it appears in the phrase "homopolymer and copolymer." This is a very common mistake. In this case, (4) is appropriate. The other possible interpretation is expressed by (4*).

19.2.4 Misused to connect clauses and verb phrases

As well as can be used to connect most kinds of single words – nouns, verbs, adjectives, adverbs and prepositions.[4] Also, it can connect most kinds of phrases – noun phrases, adjective phrases, adverb phrases and prepositional phrases. However, it cannot connect verb phrases.[5] In addition, it can never be used to connect clauses. Sometimes I find *as well as* mistakenly used to connect verb phrases and clauses. Such misuse is demonstrated below.

Verb phrases

A verb phrase consists of a main verb and an auxiliary verb.[6] The following illustrate typical misuses of *as well as* with verb phrases.

(5) The samples were sorted as well as were cleaned.
(5) The samples were sorted /as well as/and/ cleaned.
(6) During this time interval, the system begins to increase in temperature as well as begins to decrease in magnetization.
(6) During this time interval, the system begins to increase in temperature as well as decrease in magnetization.
(7) This effect has been measured as well as will be investigated in detail in the near future.
(7) This effect has been measured and will be investigated in detail in the near future.

In (5), "as well as" connects the verb phrases "were sorted" and "were cleaned." In (5) it connects the main verbs, "sorted" and "cleaned." In (6), it joins the verb phrases "begins to increase" and "begins to decrease," together with their modifiers, "in temperature" and "in magnetization."[7] In (6), it connects the main verbs, "increase" and "decrease," together with modifiers. In (7), it connects the verb phrases

[4] It cannot be used to connect articles or conjunctions, however.

[5] To this point, we have mainly considered use of *as well as* in connecting nouns. The following illustrate its use with other grammatical elements: (verbs) *τ can increase as well as decrease*; (adjectives) *The sample is dense as well as hot*; (adverbs) *These changes occur rapidly as well as completely*; (prepositions) *This reaction takes place inside as well as outside the region ξ*; (noun phrases) *The method used by Jones et al., as well as that used previously by the present author, is unable to treat the most interesting case*; (adjective phrases) *This function is smooth in the region r as well as twice-differentiable in the region $R_{\sup r}$*; (adverb phrases) *This point was most convincingly (as well as most elegantly) demonstrated by Tsatsos*; (prepositional phrases) *These conditions hold inside the sphere S_1 as well as at the point p^**. It should be kept in mind that the elements joined by *as well as* must be of the same grammatical type. Thus, for instance, it cannot be used to join a noun and a verb.

[6] For example, in the verbs *will diverge*, *has been thought* and *is being studied*, the main verbs are "diverge," "thought" and "studied," and the auxiliary verbs are "will," "has been" and "is being."

[7] These modifiers are prepositional phrases acting as adverbials.

"has been measured" and "will be investigated." In this case, there is no way to use *as well as* to properly express the intended meaning.

As these examples demonstrate, when *as well as* is used with verb phrases, it can only connect their main verbs (with the auxiliary verb being shared), not the verb phrases themselves. In the first two examples above, because the auxiliary verbs in the two verb phrases are the same, "as well as" can be used to connect the main verbs. In the last example, however, because the auxiliary verbs are different, this cannot be done.

Clauses

A clause contains a subject and a predicate (including a main verb). Consider the following.

> (8) Tension oscillations with a period of approximately 10 ms are observed in organism 1 as well as chemical oscillations with a period of approximately 4 μs in organism 2.
> (8) Tension oscillations with a period of approximately 10 ms are observed in organism 1, and chemical oscillations with a period of approximately 4 μs are observed in organism 2.
> (8*) /In addition to/As well as/ the chemical oscillations with a period of approximately 4 μs in organism 2, tension oscillations with a period of approximately 10 ms are observed in organism 1.
> (9) T_1 decays rapidly as well as T_2 grows rapidly.
> (9) T_1 decays rapidly, /and/while/ T_2 grows rapidly.

In (8), "as well as" is incorrectly used as a conjunction to join two clauses, forming the basic structure *oscillations are observed as well as oscillations are observed* (with "are observed" in the second clause implied). The two possible interpretations of the original are expressed by (8) and (8*). In (8), the statement is symmetric with respect to the tension oscillations and the chemical oscillations. In (8*), the main assertion is with regard to the tension oscillations. Here, "as well as" joins the two nouns "oscillations" and "oscillations," along with their adjectives, "tension" and "chemical". (Note that in this type of construction, "as well as" need not appear between the two nouns it is joining.) The next example is similar.

Chapter 20

aspect

The noun *aspect* is greatly overused in the papers that I proofread, and quite often it is used incorrectly. The point often missed by Japanese authors is that this word necessarily concerns the *appearance* (either actual or abstract) of something.[1] The Oxford English Dictionary [4] lists three general definitions of this word: 1. *the action of looking at* (which is obsolete); 2. *way of looking, as to position or direction* (i.e. the way in which something looks – literally or figuratively – at something else); 3. *appearance*. In the following sections, I explain separately four ways in which *aspect* is incorrectly used with meanings that correspond to none of the above.

20.1 Misused in place of *behavior*, *property*, *characteristic* and related words

Most commonly, *aspect* is erroneously used to express the meaning of one of the following: *behavior*, *character*, *characteristic*, *feature*, *manner*, *nature*, *property*. The meanings of *aspect* that come closest to those of the above words are, listed in the Oxford English Dictionary under the second general definition given above, (i) *One of the ways in which things may be looked at or contemplated, or in which they present themselves to the mind; a phase*, and listed under the third general definition given above, (ii) *The appearance presented by an object to the eye; look* and (iii) *The appearance presented by circumstances, etc., to the mind.* Clearly, none of these meanings is equivalent to any of the meanings of *behavior*, *character*, *characteristic*, *manner*, *nature* or *property*. Although (i)–(iii) are all in some sense related to one of the meanings of *feature* (i.e. *a distinctive part of a thing*), in fact, employing *aspect* as a synonym of *feature* is imprecise usage. In general, it is not a feature itself but, rather, the manner in which a feature appears when observed, considered or experienced in some way that is more accurately termed an 'aspect'.

Such uses as the following should be avoided.

(1) We attempt to understand the aspects of this set.
(2) This study reveals a great deal of information concerning the aspects of the system near the critical point.

[1] *Aspect* is derived from the Latin *aspectus*, meaning *a view* or *an appearance*.

(3) This is a fundamental aspect of this approximation method.
(4) The aspects of this behavior are more complicated than originally thought.
(5) In the chaotic regime itself, the system exhibits a succession of different aspects as the value of β is increased.
(6) The distinguishing aspect of this model is the presence of the long-range term.
(7) To model the temporal aspects of real neural networks, the oscillator neural network provides a useful framework.
(8) Only a description of the phase aspect of the chemical oscillation is essential for understanding the polarity.
(9) While great progress has been made in understanding equilibrium properties, there are many unsolved problems in the dynamical aspect.
(10) On theoretical aspects, three main results have been obtained.
(11) The aspects of the system under shear are studied in the next section.
(12) However, this can no longer be done when the non-linear aspects become important.
(13) One interesting aspect of this solution is that its μ transform is also a solution.
(14) In general, the phase and flux structure of a non-planar domain wall can be rather complicated. However, we do not consider such aspects here.
(15) This effect continuously becomes stronger below the second transition, indicating a gradual increase of the barrier strength. This is an aspect which also appears in the hysteresis experiment discussed in the next section.
(16) This is an indispensable aspect of the model.
(17) This model includes some new aspects, including noncommutative solitons.

In all cases here, the problem with "aspect(s)" is that, judging from the overall content of each sentence, the meaning it is intended to express is *not* one regarding the way that something appears or can be viewed. The best words to replace "aspect(s)" in the above are as follows: (1) *properties*; (2) *nature*, *properties*, *behavior*; (3) *feature*, *characteristic*, *property*; (5) *types of behavior*, *features*; (6) *characteristic*, *feature*; (7) *behavior*; (8) *component*, *behavior*, *dependence*, *properties*, *characteristics*, *features*, *nature*; (11) *behavior*, *properties*; (12) *behavior*; (13) *characteristic*, *property*; (14) *features*; (15) *feature*, *behavior*; (16) *feature*, *characteristic*, *element*, *property*, *quality*; (17) *features*, *phenomena*. In (4), "The aspects of this behavior" should be changed to *This behavior*, in (9), "in the dynamical aspect" should be changed to *regarding dynamical behavior*, and in (10) "On theoretical aspects" should be changed to *Theoretically* or *In theoretical studies*.

The above examples should be contrasted with the following.

(18) There are certain aspects of this behavior that are puzzling within the understanding provided by the present theory.

(19) The somewhat cumbersome aspect of the analysis is problematic.
(20) Transiently synchronous inputs are necessary to describe some aspects of spiking statistics.
(21) There is an important polymer-like aspect of fracture in gels.
(22) We now comment on some aspects of the matching procedure.
(23) Several previously unknown aspects of the learning process have been elucidated by recent unconventional experimental studies.

These sentences all in some sense regard a certain manner in which something appears or a certain manner in which something can be viewed. For this reason, they are quite natural. In all of these but (19), "aspect(s)" could be replaced by *feature(s)* or *characteristic(s)*, and in all but (19), (22) and (23), it could be replaced by *property(ies)*. While the resulting sentences would differ little in substance from the originals, there would be slight differences in nuance. In the above sentences, "aspects of this behavior," "aspect of the analysis," "aspects of spiking statistics," "aspect of fracture," "aspects of the matching procedure" and "aspects of the learning process" all refer to the *appearance* of these things when we consider them in certain ways. If we changed "aspect(s)" to *features(s)*, *characteristic(s)* or *property(ies)*, these sentences would no longer be concerned with the somewhat subjective matter of how things appear when viewed in a certain manner but, rather, with the more objective matter of the qualities that they possess. In (19) (and only in (19)), "aspect" could be replaced by *nature*. This would change the overall meaning of the sentence, however. The above expresses the idea that there is something about the analysis that is cumbersome. With *nature*, this sentence would imply that the analysis as a whole is cumbersome.

20.2 Misused in place of *point*

The second manner in which I find *aspect* often misused is in place of the word *point*. The following are typical.

(1) It was found by Gray [3] that the resulting equation can be interpreted as a type of conservation law. This is an interesting aspect.
(2) There remain many subtleties and controversial aspects that were not covered in this article.

In both sentences here, "aspect" should be replaced by *point*. In (1), *observation* or *interpretation* could also be used. In (2), several other words are possible, including *topics*, *results* and *claims*.

20.3 Misused in place of *context* or *situation*

The third common way I find *aspect* misused is demonstrated by the following.

(1) The optical properties of the CuCl nanocrystals have been studied in several aspects.

(1) The optical properties of the CuCl nanocrystals have been studied in several /contexts/situations/.
(1*) The optical properties of the CuCl nanocrystals have been studied from several points of view.
(1**) The optical properties of the CuCl nanocrystals have been studied in several ways.
(2) Many properties of the glass transition in glass-forming materials have been clarified by recent progress in both experimental and theoretical aspects.
(2) Many properties of the glass transition in glass-forming materials have been clarified by recent progress in both experimental and theoretical contexts.
(2*) Many properties of the glass transition in glass-forming materials have been clarified through recent findings in both experimental and theoretical studies.
(3) On theoretical aspects, we have derived the phase diagram of the concentration of polymer lipids.
(3) /Theoretically/In a theoretical context/, we have derived the phase diagram of the concentration of polymer lipids.
(3*) We have derived the phase diagram of the concentration of polymer lipids theoretically.

The meaning of (1) is quite unclear. It seems the intended meaning is that given by either (1) or (1*). The most direct interpretations of (2) and (3) are expressed by (2) and (3), but in fact it seems that the intended meanings are those given by (2*) and (3*).

20.4 Misused in place of *respect*

The following demonstrate the fourth common misuse of *aspect*.

(1) In several important aspects, however, our theory is different from the original.
(1) In several important /respects/ways/, however, our theory is different from the original.
(1*) With respect to several important points, however, our theory is different from the original.
(2) The time gauge simplifies the above expression in two aspects.
(2) The time gauge simplifies the above expression in two /respects/ways/.
(3) The brain is an open system in both energetic and informatic aspects.
(3) The brain is an open system in both energetic and informatic respects.
(3*) The brain is an open system with respect to both energy and information.

In no case can *aspect* be used as a synonym of *respect*.

Chapter 21

assure vs. *insure*, *ensure*, *guarantee*

While the verb *assure* is similar in meaning to *insure*, *ensure* and *guarantee*, the former has a somewhat less certain implication. Indeed, it is more similar to *attest*, *give reason to believe*, *provide evidence that* and *reassure*. Also, it is very often used with respect to a particular person or group of people (acting as the direct object), as illustrated by the following.

> (1) The simple form of this equation itself assures us of its general usefulness.

In this sense, *assure* has a somewhat relative connotation. In the example here, there is the implication that although the simplicity of this equation assures "us" of its usefulness, it may not assure other people in the same way. As illustrated by (1), *assure* is most naturally used with regard to a person's opinion or state of mind. By contrast, the meanings expressed by *insure*, *ensure* and *guarantee* are quite certain and absolute. These words are not used with regard to a person's opinion or state of mind but, rather, with regard to objective facts. Also, they are used in the situation in which there is a direct cause-effect relation, while *assure* is used in situations that are less direct.[1]

Consider the following.[2]

> (2) Using this more generally valid approach assures that we will correctly account for the swelling behavior.
> (2) Using this more generally valid approach /insures/ensures/guarantees/makes certain/ that we will correctly account for the swelling behavior.

[1] The Oxford English Dictionary [4] lists three meanings of *assure* that are synonymous with *guarantee*. However, each of these is characterized as either "obsolete" or "rare." It lists one current meaning that is synonymous with *insure*: *to make safe from or against risks*. (The American Heritage Dictionary of the English Language [1] describes this meaning as "chiefly British.") It also lists one current meaning that is synonymous with *ensure*: *to make certain the occurrence or arrival of (an event)*. All other current meanings listed in the Oxford English Dictionary, except one (which is *to make stable*), involve a person's state of mind, with regard to feeling certain, confident or satisfied. The first three definitions given by The American Heritage Dictionary of the English Language also involve a person's state of mind: 1. *to inform positively, as to remove doubt*; 2. *to cause to feel sure*; 3. *to give confidence to; reassure*.

[2] The problem considered here apparently results from the mistaken translation of 保証 as *assure*. While there are cases in which this is appropriate, usually it is not.

(3) The close agreement between our results and the experimental results of Kim insures us of their validity.
(3) The close agreement between our results and the experimental results of Kim assures us of their validity.

The first sentence here could be made meaningful by simply adding the direct object of "assures" (for example, by changing "assures" to *assures us*). The resulting sentence, however, would express a somewhat unnatural meaning. Its implication would be that the relation between using this more valid approach and correctly accounting for the swelling behavior is somewhat indirect – that using this more valid approach, there is reason to believe that we will correctly account for the swelling behavior, but, in fact, we cannot be entirely sure about this. Here, the more direct implication of "insures/ensures/guarantees/makes certain" is appropriate.[3] The situation is quite different with the second example. Here, note that the actual relation between the agreement of these two sets of results and our belief in the validity of "our results" is somewhat indirect and subjective. In particular, it involves our state of mind.

[3]Note that the main problem with *assures us* here is not its somewhat tentative implication but the indirect relation it expresses. Because it expresses such a relation, it would not be appropriate even in the case that there is some doubt about whether this approach will have the stated result. In such a situation, this could be written as follows: *We believe that by using this more generally valid approach, we will correctly account for the swelling behavior.*

Chapter 22

at first and *at last*

Here I discuss misuses of the expressions *at first* and *at last*.

22.1 *at first*

22.1.1 Correct use

The adverbs *at first* and *first* are generally not interchangeable. The former has a narrower meaning and is used almost exclusively in regard to time. It can usually be replaced by something like *in the beginning* or *at the initial time*. In some situations *first* can also be used in regard to time, but more often it is used in regard to order. The following demonstrate this distinction.

(1) First, we diagonalize M.
(2) At first, the energy is localized in the cell located at $x = 0$, but after 100 time steps, it is almost evenly distributed over all the cells.

In (1), the intention is to identify the first in a set of steps, while in (2), the intention is to describe the state of the system at the initial time. (Note that, without altering the meaning, "first" in (1) could be replaced by *to begin with*, while "at first" in (2) could be replaced by *in the beginning*, *at the beginning* or *initially*.) Neither "at first" nor "first" could be changed to the other here. Although the sentences resulting in each case would be in no way incorrect, their meanings would differ from the original meanings. The sentence obtained from (1) by adding *at* would imply that this diagonalization was carried out at some initial time, while that obtained from (2) by deleting "at" would imply that we localize the energy as the first step in some process. The situations described by both of these sentences would be quite unusual.

22.1.2 Incorrect use

While misuse of *first* in situations like (2) is quite rare, that of *at first* in situations like (1) is fairly common. The following are typical.[1]

[1]The most common problem involving the use of *at first* seems to result from the misconception that it corresponds to まず. In fact, it generally can be translated as 初めに.

(3) At first, we recall the necessary and sufficient condition for M^n to be locally conformally flat.
(4) The experimental data are analyzed at first using the phenomenological optical potential and then compared with the microscopic theory.
(5) We change the sign on all odd terms at first, and then we apply the operator P.
(6) It is necessary at first to take the $\delta \to 0$ limit.

In each of these, "at first" should be changed to *first.* In (3)–(5), *to begin with* could also be used.

The above should be contrasted with the following correct uses of *at first.*

(7) The analysis shows that, as the frequency of the external field increases, all of the tunneling rates are significantly enhanced at first but eventually tend rapidly to zero.
(8) At first, one phase wave propagates from either end.

In both of these sentences, "at first" could be replaced by *initially* without changing the meaning. Here, *in the beginning* and *at the beginning* sound somewhat unnatural, although neither could be considered wrong.

22.2 *at last*

The expression *at last* means *after a considerably long time.*[2] I sometimes find it misused to mean something like *as a final step* or *in the end.*[3] The following are typical examples.

(1) This structure gradually becomes smaller and disappears at last.
(1) This structure gradually becomes smaller and finally disappears.
(2) This non-trivial behavior continues for some time $\sim T$, but eventually the system approaches the fixed-point attractor, and at last this is where the system comes to exist.
(2) This non-trivial behavior continues for some time $\sim T$, but eventually the system approaches the fixed-point attractor, and in the end this is where it comes to exist.
(2*) This non-trivial behavior continues for some time $\sim T$, but eventually the system approaches the fixed-point attractor, and this is where it finally comes to exist.
(2**) This non-trivial behavior continues for some time $\sim T$, but the system converges to the fixed-point attractor in the $t \to \infty$ limit.
(3) At last, combining the above partition functions and integrating over the gauge field strength, we obtain an effective potential.
(3) Finally, combining the above partition functions and integrating over the gauge field strength, we obtain an effective potential.
(4) At last in this section we give some examples.

[2] For example, see The American Heritage Dictionary of the English Language [1].
[3] The problem considered here seems to result from the mistaken translation of 最後に as *at last.*

(4) /To end/Before ending/Finally in/ this section, we give some examples.

(4*) We end this section with some examples.

The use of "at last" in (1) and (2) carries with it an inappropriate subjective implication that the situations in question take a long time to realize. There is no such implication in (1), (2), (2*) and (2**), which simply assert that these are the situations realized in the end or asymptotically. ((2), (2*) and (2**) express essentially the same meaning. The first two of these are more accurate expressions of the assertion intended by the author, but the last one is more concise and mathematically more precise.) The use of "at last" in (3) seems to imply that it has taken an inordinately or unexpectedly long time to reach the present point in the calculation. The feeling this sentence conveys is somehow that by this point, both the author and reader are tired. This, clearly, is not a desirable implication. The problem is similar in (4).

Chapter 23

at the same time

The expression *at the same time*, which acts as an adverb, has two quite different meanings, one synonymous with *however* or *nevertheless* and one synonymous with *simultaneously*. To go along with these two different types of usage, there are two ways that *at the same time* is commonly misused.

23.1 Expressing the meaning of *however* or *nevertheless*

23.1.1 Inappropriate use

When *at the same time* does not express a time-like meaning (that is, a meaning of simultaneity), it is used to connect contrasting and in some sense contrary or opposing assertions. In this role, it is synonymous with either *however* or *nonetheless/nevertheless*. I often find this expression misused to simply change the topic of discussion or to connect similar or only contrasting (i.e. non-opposing) statements. Usually in such situations it is intended to express a meaning something like that of *and*, *also*, *similarly*, *while* or *contrastingly*. Such usage is simply wrong, as *at the same time* is synonymous with none of these.[1]

Consider the following.

> (1) We have investigated these equations in the low temperature regime using the method described in Ref. [1]. At the same time, Quinton et al. [6] investigated them in the high temperature regime using a method that differs (apparently) only slightly. As a future problem, we wish to consider how these two methods can be combined to obtain a more complete understanding of the equations.
>
> (1) /Whereas/While/ we have investigated these equations in the low temperature regime using the method described in Ref. [1], Quinton et al. [6] investigated them in the high temperature regime using a method

[1] In this section we consider the most common erroneous use of *at the same time*. In this case, it is misused to express the meaning of 一方. Apparently, this misuse results from the direct translation of 同時に. It should be noted that when 同時に is used as a synonym of 一方, it cannot be translated as *at the same time*. This misuse is similar to that of *on the other hand*, discussed in Chapter 91. Other misuses illustrated in this section are similar to certain misuses of *however* and *on the contrary*, discussed in Chapters 65 and 90.

that differs (apparently) only slightly...

(2) In the n-th order approximation, we ignore the last term in (5.1). At the same time, we assume that third term can be treated as a perturbation.

(2) In the n-th order approximation, we ignore the last term in (5.1). /In addition/Also/, we assume that the third term can be treated as a perturbation.

(3) We move all of the fields, $\phi_q, \phi_{\bar{q}}$ and $\Lambda_{\tilde{N}_c}$, from one side of the duality relation to the other. At the same time, we replace these by their anti-fields.

(3) We move all of the fields, $\phi_q, \phi_{\bar{q}}$ and $\Lambda_{\tilde{N}_c}$, from one side of the duality relation to the other and replace them by their anti-fields.

(4) The parameter set must be chosen to be consistent with data for other incident energies and nuclei. At the same time, certain theoretical results are also necessary to uniquely determine the parameter set.

(4) ...Certain theoretical results are also necessary to uniquely determine the parameter set.

(5) We concentrate here on SU(3) baryons, because computationally they represent the simplest case. At the same time, there are sufficient data to allow for a systematic comparison with experiment.

(5) ...In addition, there are sufficient data to allow for a systematic comparison with experiment.

(6) The mass scale of the fermions is provided by the former, and at the same time, the mass scale of the right-handed neutrino is provided by the latter.

(6) The mass scale of the fermions is provided by the former, /while/and/whereas/ the mass scale of the right-handed neutrino is provided by the latter.

(7) As seen in Fig. 2, $\tau_1(N)$ diverges in the $N \to \infty$ limit and converges to 1 in the $N \to -\infty$ limit. At the same time $\tau_2(N)$ diverges in the $N \to -\infty$ limit and converges to -1 in the $N \to \infty$ limit.

(7) ...Contrastingly, $\tau_2(N)$ diverges in the $N \to -\infty$ limit and converges to -1 in the $N \to \infty$ limit.

In (1), the intended use of "at the same time" is simply to shift the focus of the discussion. This use results in an illogical connection between these two sentences. Although "while" and "whereas" as used in (1) are similar to *at the same time* in that they imply some kind of contrast, they do not have the same strong meaning of *however* or *nonetheless*. Example (2) is problematic because, rather than expressing contrasting meanings, these two sentences describe similar things – two approximations applied to some analysis. In (3), "at the same time" could be interpreted as being synonymous with *simultaneously*, but the way this is rewritten in (3) is more natural. The two sentences in (4) describe complementary rather than contrasting conditions. In (5), both sentences represent arguments for studying the SU(3) baryons. The situation in (6) is similar to that in (1). While the statements in (7) do describe contrasting situations, this contrast is between two different things, and thus the condition of opposition that is necessary for use of *at the same time* is

lacking.

23.1.2 Appropriate use

The following sentences demonstrate the proper use of *at the same time* in the role considered presently.

> (8) We find that this operation can never be carried out quasi-statically but, at the same time, the accompanying irreversible work can be made arbitrarily small.
> (9) The interactions among these constituent systems are assumed to be sufficiently weak that their contribution to the total energy of the combined system is negligible, but, at the same time, sufficiently strong that the combined system is ergodic.
> (10) A sufficiently large system is necessary to properly model the twisting action. At the same time, because we are interested in long-time behavior, our present computational resources limit the system size to approximately 100×100.

In (8) and (9), "at the same time" could be replaced by *nonetheless* or *nevertheless* without changing the meaning. In (9), *on the other hand* could also be used. The meaning of "at the same time" is different in (10). Here this expression could be replaced by *however*. Note that in each of the above, the two clauses or two sentences describe contrasting and, in some sense, opposing situations. In (8), the statement that this operation cannot be done quasi-statically may lead one to believe that the irreversible work cannot be made small, but the second clause refutes this conclusion. In (9), roughly speaking, the first clause states that the interactions are small, and the second states that they are not small. In (10), the first sentence asserts that the system must be large, while the second asserts that it cannot be large.

These three examples provide and understanding of the difference between *at the same time* and *on the other hand* (see Chapter 91). These two expressions are similar and, indeed, in some cases interchangeable. However, as illustrated by (8)–(10), *at the same time* can be used in situations that the opposition in question is too indirect to allow use of *on the other hand*. Note that (9) presents directly opposing conditions rendered by different points of view. This typifies the type of situation that *on the other hand* can be used to describe. Contrastingly, this expression could not be used in either (8) or (10), because the two assertions appearing there are not in direct opposition. This is fairly clear in (8) but perhaps somewhat more subtle in (10). In the latter case, *on the other hand* would be appropriate if the second clause were changed to something like *...it must be sufficiently small to allow for investigation of long-time behavior*. In this case, the opposition expressed by the first and second clauses would be sufficiently direct.

23.2 Use with a time-like meaning

Although *at the same time* can be used as a synonym of *simultaneously*, with regard to the behavior of a mathematical or physical system, there are situations when this

use should be avoided. Here I discuss two of these.

23.2.1 Misused in reference to multiple times

To understand the first situation, consider the example below.

> (1) These processes take place at the same time.
> (1) These processes take place simultaneously.

When describing the behavior of a system under study in a mathematical or scientific context, where precision is usually necessary, when used with a time-like meaning, *at the same time* should only be used in reference to a single time. (As demonstrated by (6) below, this need not be a 'time' in the literal sense.) The original here is poor because in it, "at the same time" is being used in reference to a time interval. (Note that a "process" cannot take place at a single point in time.) Although in non-scientific contexts this phrase is often used in reference to finite periods of time, when describing phenomena that are the subject of scientific or mathematical study, this should be avoided in favor of *simultaneously*.

The following presents another example of *at the same time* being used to refer to something other than a single point in time.

> (2) These two effects appear repeatedly and always at the same time.
> (2) These two effects appear repeatedly and always simultaneously.

Employing a strict interpretation of "at the same time," (2) seems to be describing the situation in which these two effects appear together again and again, but the values of the time variable at which they appear are all equal, in which case we would evidently be considering a cyclic time variable. In fact, if this were indeed the situation under consideration, "at the same time" would be quite appropriate. The more plausible interpretation, however, is that the effects appear simultaneously at several times. Note that in some sense, the problem with the presently considered use of *at the same time* is that, in accordance with an elementary rule of English grammar, the singular noun *time* cannot be used in reference to multiple times. However, this does not mean that the original sentence can be fixed by simply changing "time" to *times*. In fact, this would result in something even worse.

23.2.2 Misused as a synonym of *at a single time*

The second problematic time-like use of *at the same time*, which we now consider, is not as serious as that discussed above, but it does deserve mention. This problem is demonstrated below.

> (3) Among the numerical solutions of this system that we have studied, there is one in which two defects appear at the same time.
> (3) Among the numerical solutions of this system that we have studied, there is one in which two defects appear /simultaneously/at a single time/.
> (4) The conditions $e^{-\Phi_1/T}\Phi_\infty \ll T$ and $\Phi_\infty \gg T$ cannot be satisfied at the same time.

(4) The conditions $e^{-\Phi_1/T}\Phi_\infty \ll T$ and $\Phi_\infty \gg T$ cannot be satisfied /simultaneously/at a single time/.

While (3) and (4) cannot be regarded as incorrect, (3) and (4) are preferable. This is because, in its proper usage, *at the same time* refers to some previously specified time.[2] When this is not the case, its use is somewhat unnatural. In the examples above, in fact, "at the same time" is not employed in this manner, and as a result, without referring to any time in particular, it only expresses the condition of simultaneity. In these sentences, the intended meaning can be expressed by changing "at the same time" to "at a single time" (although "simultaneously" is a better choice). Strictly interpreted, these expressions do not possess the same meaning, and therefore in mathematical and scientific discussion they should not be used synonymously. However, again it should be stressed that the problem with the above sentences is due to the mathematical nature of the discussion. In ordinary English, where precision in the choice of expressions is not of primary importance, this usage of *at the same time* is quite natural.

23.2.3 Correct use

The above sentences demonstrating the problematic time-like use of *at the same time* should be compared with the following.

(5) The spins are aligned at $t = t_0$, and at the same time, the field is turned off.
(6) We wish to determine a $\mathbf{5}^*$ family structure that can predict the down quark spectrum and CKM mixings and, at the same time, the large lepton mixing angle.

In (5) and (6), in contrast to the situations considered above, the "time" in question is a previously specified, single time. In (5), this is an actual time, "t_0," while in (6) it is the *case* in which the down quark spectrum and CKM mixings can be predicted.

[2] This is due to the meaning imparted by *the*.

Chapter 24

available

24.1 Improper use

The adjective *available* is very often misused in the papers I proofread. In fact, its incorrect use is probably more common than its correct use. The following are representative examples.[1]

(1) The powerful method of constructing a gauge invariant energy-momentum tensor formulated by Schwinger is thus not available.
(1) The powerful method of constructing a gauge invariant energy-momentum tensor formulated by Schwinger /is thus not applicable/is thus not effective/thus cannot be used/.
(2) The recently available ^{11}Li+p elastic and inelastic scattering data at E_{lab}=68A MeV are considered.
(2) /Recent/Recently obtained/ ^{11}Li+p elastic and inelastic scattering data at E_{lab}=68A MeV are considered.
(3) Within the CTP formalism, however, no self-consistent derivation of this scheme is available.
(3) Within the CTP formalism, however, no self-consistent derivation of this scheme /exists/has been given/.
(4) However, here the change in the electron polarization for the scattering process has been disregarded because the required formulas were not available.
(4) However, here the change in the electron polarization for the scattering process has been disregarded because the necessary formulas /do not exist/cannot be applied/are not in the proper form/.
(5) Other supersymmetric string theories are not available.
(5) No other supersymmetric string theories /apply to/can be used in/ the present case.
(5*) No other supersymmetric string theory exists.
(6) However, since exact dynamical results are not available, the model

[1] It seems that most of the misuses illustrated here result from the mistaken translation of either 有効な or 存在する. Although there are situations in which these expressions can be translated as *available*, these are quite special.

has not been verified.
(6) However, because exact dynamical results do not exist, the model has not been verified.
(7) If we consider sufficiently large values of N, the large N systematic expansion becomes available.
(7) If we consider sufficiently large values of N, the large N systematic expansion /becomes applicable/can be used/becomes effective/becomes feasible/.
(8) Many textbooks that give complete derivations of these equations are available.
(8) There are many textbooks that give complete derivations of these equations.
(9) At present, the forms of these interactions are available only for the Λ.
(9) At present, the forms of these interactions are known only for the Λ.
(10) There is no experimental result for the $K^-p \to \phi\Lambda$ reaction available covering the momentum range of interest.
(10) There is no experimental result for the $K^-p \to \phi\Lambda$ reaction covering the momentum range of interest.
(11) For the early stage of crystallization, real-time observations using several experimental techniques are available.
(11) For the early stage of crystallization, real-time observations using several experimental techniques /can be made/are useful/are feasible/.
(12) A self-consistent equation is available by minimization of the energy functional.
(12) A self-consistent equation can be obtained through minimization of the energy functional.
(13) Only a numerical approach based on the lattice gauge theory is available to study these states.
(13) At present, there is only a numerical approach based on lattice gauge theory that can be used to study these states.
(14) This result implies that the phenomenological analyses given in Ref. [4] are available in the non-perturbative region.
(14) This result implies that the phenomenological analyses given in Ref. [4] /are applicable/can be applied/are valid/can be used/ in the non-perturbative region.
(15) For the vertex functions, such a procedure is not yet available.
(15) For the vertex functions, such a procedure /does not yet exist/has not yet been formulated/.
(16) Only five data points for $T_{\max}$ are available, and therefore we cannot yet deduce its functional form.
(16) We have only five data points for $T_{\max}$, and therefore we cannot yet deduce its functional form.
(17) In this case our analysis can be greatly simplified, because phase models of the following forms become available:
(17) In this case our analysis can be greatly simplified, because phase

models of the following forms become applicable:
(18) This result is available only for sufficiently small values of the Rayleigh and Reynolds numbers.
(18) This result is valid only for sufficiently small values of the Rayleigh and Reynolds numbers.
(19) These equations are available for the energy region satisfying $\mu > \mathcal{M}_{\mathcal{R}}$.
(19) These equations /apply to/describe/ the energy region satisfying $\mu > \mathcal{M}_{\mathcal{R}}$.
(20) If such an operator is available, it can be used to generate any excited state.
(20) If such an operator /exists/is applicable/, it can be used to generate any excited state.
(21) The available neutron star models suggest higher concentrations.
(21) /Existing/Present/ neutron star models suggest higher concentrations.
(22) This field redefinition is not available in our model.
(22) This field redefinition /cannot be made/is meaningless/is not possible/is not effectual/is of no consequence/ in our model.

As demonstrated by the above examples, *available* is most commonly misused when the intended meaning involves a condition of *applicability*, *effectiveness* or *existence*, rather than one of *availability*.[2] Note that these conditions are all quite different: availability characterizes the state of an entity, effectiveness characterizes the action of an entity, and applicability characterizes the relation between two entities, while existence is obviously a prerequisite for anything characterized by any of these. Something can be described as 'available' if its functioning or utilization is not prevented, 'applicable' if it is capable of being used for a specified purpose, and 'effective' if it is capable of producing a particular result.

Note that in the situation described by (1), the characterization of this method as "not available" is inaccurate. Obviously, there is nothing preventing us from attempting to use it. Such an attempt, however, will end in failure, because this method is inapplicable or ineffective in the present case. The implication of (3) seems to be that such a self-consistent derivation of "this scheme" exists but that something is preventing us from using it. This is clearly not the intended meaning. The remaining examples are similar.

To avoid the type of misuse demonstrated above, it is perhaps best to keep the following image in mind: To say that something is 'available' means that it is simply *existing in a state of usability*, nothing more and nothing less.

[2]In the past, *available* was used as a synonym of *applicable* and *effective*, but in modern usage it has no such meanings. (According to the Oxford English Dictionary [4], the meaning *capable of producing the desired result* or *effectual* is archaic or obsolete, except in legal usage, while the meaning *of advantage*, *beneficial*, *profitable* or *serviceable* is obsolete. The only current meaning listed there is *capable of being employed* or *at one's disposal*.)

24.2 Proper use

The above incorrect uses of "available" should be compared with the following.

> (1) In this case there are more available degrees of freedom into which energy can flow.
> (2) Because the available computational power is much greater today than at that time, it may now be feasible to carry out an analysis of the full data set.
> (3) However, in this case such a transition cannot be made, because the available energy is less than that required to reach the threshold.

In these examples, in contrast to those above, the nouns modified by "available" indeed do represent things for which the characterization of *existing in a state of usability* is definitive: In the situation described by (1), the idea that nothing prevents these degrees of freedom from functioning to receive and store energy (and thus that they are *usable*) is very natural, and represents their most relevant characterization;[3] (2) is appropriate because the relevant idea here is that (at least ideally) nothing prevents the utilization of this computational power; (3) is similar to (1), because the important point is that the system is free to use this energy.

[3]Note that it is entirely possible that there exist additional degrees of freedom which are not available (because of some kind of restriction) to receive energy.

Chapter 25

based

The word *based* (the passive form of the verb *base*) can be used as a passive verb or as a passive participle.[1] I often find *based* misused as an adverb, modifying a verb. This usage is grammatically incorrect and should be strictly avoided.[2] Here I present some typical examples.[3]

25.1 Incorrect use

(1) Based upon these considerations, we prove the existence of complex eigenvalues.
(1) /With/Using/On the basis of/ these considerations, we prove the existence of complex eigenvalues.
(2) The following definition was given, based on the ternary Cantor set.
(2) The following definition is based on the ternary Cantor set.
(3) In the present paper we study, based upon an improved numerical method, the universality of the complex eigenvalues in the scalar-scalar ladder model.
(3) In the present paper we study the universality of the complex eigenvalues in the scalar-scalar ladder model using an improved numerical method.
(4) In the following sections we prove the above statement based on the ergodicity hypothesis of Hamiltonian dynamical systems.
(4) In the following sections we prove the above statement, basing our arguments on the ergodicity hypothesis of Hamiltonian dynamical systems.
(5) Based on the inequalities (3.1), we show in the following sections that the process $\{T_1, a_1; T_2, a_2\}$ is generally irreversible.
(5) /Using/On the basis of/ the inequalities (3.1), we show in the follow-

[1] A participle is a verb form that can function as an adjective. There are two types of participles, active (e.g., *writing*, *breaking*) and passive (e.g., *written*, *broken*). Active and passive participles are also called ‘present’ and ‘past’ participles.

[2] It is important to note that, in general, if ... に基づいて is directly translated as *based on...*, this grammatical mistake results.

[3] This chapter should be considered in conjunction with Chapter 89, where I discuss *on the basis*.

ing sections that the process $\{T_1, a_1; T_2, a_2\}$ is generally irreversible.
(5*) With an argument based on the inequalities (3.1), we show in the following sections that the process $\{T_1, a_1; T_2, a_2\}$ is generally irreversible.
(6) The player decides on an action to take based upon his own decision-making mechanism.
(6) The player's decision on the action to take is based upon his own decision-making mechanism.
(6*) The player decides on an action to take according to his own decision-making mechanism.
(7) Their decision is made based on $x(t)$ and $y(t)$.
(7) Their decision is based on $x(t)$ and $y(t)$.
(8) The score landscapes constructed based on the determining functions g_i are plotted in Fig. 4.
(8) The score landscapes based on the determining functions g_i are plotted in Fig. 4.
(8*) The score landscapes constructed using the determining functions g_i are plotted in Fig. 4.
(9) Based on this observation, we first examine the simplest case.
(9) /With/On the basis of/ this observation, we first examine the simplest case.
(9*) Employing an approach based on this observation, we first examine the simplest case.
(10) In this paper, based on our hypotheses, we explore new coupling unifications.
(10) In this paper, /using/on the basis of/ our hypotheses, we explore new coupling unifications.
(10*) In this paper, we undertake an exploration of new coupling unifications that is based on our hypotheses.

In each of the above sentences, "based on" or "based upon"[4] is being used as an adverb, modifying a verb. The verb in each case is as follows: in (1) "prove"; in (2) "was given"; in (3) "study"; in (4) "prove"; in (5) "show"; in (6) "decides"; in (7) "is made"; in (8) "constructed"; in (9) "examine"; in (10) "explore."

Based is a verb form. When it is used grammatically as a verb, its subject must appear. For example, we have the construction *[noun 1] + is based on + [noun 2]*. Here, *[noun 1]* is the subject of "based," and *[noun 2]* is the object of the preposition "on." Similarly, when *based* is used grammatically as an adjective (i.e. in the form of a participle), the noun that it modifies must appear. For example, we have *[noun 1] + based on + [noun 2]*. In this case, "based" modifies *[noun 1]*, and *[noun 2]* is again the object of the preposition "on." In both of these constructions, the resultant meaning is that *[noun 1] has as its base [noun 2]*, *[noun 1] is supported by [noun 2]* or *[noun 1] is derived from [noun 2]*. In each of the above original sentences, such a *[noun 2]* appears, but *[noun 1]* is absent (or does not appear in the grammatically correct manner).

[4]The expressions *based on* and *based upon* are essentially identical in meaning.

25.2 Correct use

The following demonstrate the proper use of *based*.

(1) Our calculation is not based on Eq. (17) itself.
(2) We employ the standard prescription based on perturbation theory.
(3) This difference is caused by the fact that the perturbative or path-integral approach is based upon the T*-product.
(4) Equation (6) is interpreted, through consideration based on Eq. (1), as the effective action.
(5) This method is also free from most astronomical ambiguities, because it is based upon geometrical relations.
(6) The original formulation for the gauge theory based on NCG is sometimes inconvenient.
(7) The model is based on the $U(1)_R$ symmetry.
(8) These three schemes are based on the same assumption.
(9) It is quite reasonable that the present model based on the mean field picture does not yield a good fit.

In (1), (3), (5), (7) and (8), "based" acts as a verb,[5] and in (2), (4), (6) and (9) as an adjective.

[5] More precisely, it is the main part of the full verb "is based" or "are based."

Chapter 26

because of

In the papers that I proofread the preposition *because of* is greatly overused and misused in several ways.[1] In this chapter I consider its most common types of misuse.[2]

26.1 Inappropriate use with the noun *reason*: *because of* vs. *for*

Although a prepositional phrase introduced by *because of* can be used to express a reason, that which acts as the object of this phrase does not itself represent a reason. The following demonstrates this point.

> Because of the weather, we cannot leave tomorrow.

In this case, "weather" itself is not the reason that "we" cannot leave. This reason is, for example, that *the weather is bad*.[3] As this sentence demonstrates, that which acts as the object of the preposition *because of* is not a reason but, in some sense, the *source* of a reason.[4] Consequently, the sentence below is logically flawed.

> (1) The thickness dependence of the critical temperature cannot be reliably determined in this regime because of the same reason.

This seems to imply that the source of the reason that this dependence cannot be determined is "the same reason." Clearly the author did not wish to make such a logically convoluted statement. The simplest way to remedy this problem is to change "because of" to *for*. This sentence could also be rewritten something like the following.

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[1]This expression is synonymous with *owing to* and *by reason of*, and the discussion given in this chapter applies to these as well. However, the types of problems discussed here are much more common with *because of*, and for this reason I focus on it.

[2]Several of the problems treated here apparently result from the inappropriate translation of ...のために as *because of*.... Of course, in some situations such a translation is appropriate, but usually it is not.

[3]See Chapter 106, Section 1 for related discussion of *reason*.

[4]This can be seen more clearly by noting that, as mention above, *because of* is synonymous with *by reason of*.

(1) The thickness dependence of the critical temperature cannot be reliably determined in this regime because of the same /problem/difficulty/behavior/conditions/.../.

With anything that can be thought of as the source of a reason acting as the object of "because of," this sentence is very natural. Note that in this sentence, "because of" cannot be replaced by *for*. The difference between the prepositions *because of* and *for* when used to express a reason or cause thus becomes clear: *because of* cannot introduce the word *reason*, but it can introduce almost any noun that represents the source of a reason, while *for* can in most such situations only introduce the word *reason*.

I end this section with several additional typical examples.

(2) We follow this seemingly convoluted set of steps because of two reasons.
(2) We follow this seemingly convoluted set of steps for two reasons.
(2*) We follow this seemingly convoluted set of steps because of two complicating circumstances.
(3) This happens because of the above stated reason.
(3) This happens for the above stated reason.
(3*) This happens because of the above described situation.
(4) We did not investigate at temperatures below T_c because of two reasons.
(4) We did not investigate at temperatures below T_c for two reasons.
(4*) There are two reasons that we did not investigate at temperatures below T_c.

26.2 The preposition *because of* vs. the conjunction *because*

Expressions employing the conjunction *because* and the preposition *because of* can often be used interchangeably. This can be seen by considering the following rewritten form of the example given in the previous section.

Because the weather is bad, we cannot leave tomorrow.

As this illustrates, in some cases, there is no essential difference in the information presented by a prepositional phrase introduced by *because of* and a subordinate clause introduced by *because*. However, as we see in this section, in many cases, the intended meaning can be naturally expressed only by the latter.

26.2.1 Problem of meaning

Consider the following examples.

(1) However, the distributions for these quantities are similar because of the same spin dependence.
(1) However, the distributions for these quantities are similar because

they have the same spin dependence.
(2) This case is easier to treat because of no singularity.
(2) This case is easier to treat because there is no singularity.
(3) Because of the perturbative treatment of χ, we cannot make as strong a claim in the present case.
(3) Because the treatment of χ is perturbative, we cannot make as strong a claim in the present case.
(3*) Owing to the very simple nature of the perturbative treatment of χ, we cannot make as strong a claim in the present case.
(4) The behavior is quite complicated in this case because of many degrees of freedom.
(4) The behavior is quite complicated in this case because there are many degrees of freedom.
(5) However, this quantity vanishes because of $\theta_n = 2^n$.
(5) However, this quantity vanishes because $\theta_n = 2^n$.

The assertion in each of the above original sentences lacks the necessary information to clearly express the intended meaning. For example, in (1), while the intention is apparently to state that because these quantities have the same spin dependence their distributions are similar, in fact, the information that they possess the same spin dependence is missing. With a literal interpretation of this sentence, the reader is led to believe that this "same spin dependence" is some phenomenon that is independent of "these quantities" and that somehow this phenomenon has some effect on the distributions in question. In (2), the connection between the fact that "this case" is easier and the phrase "no singularity" is uncertain. In (3), it is unclear what about this perturbative treatment precludes the possibility of making a strong claim. For example, it could be the nature of this particular perturbative treatment or, simply, the fact that it is perturbative that causes the problem. The latter interpretation, as expressed by (3), seems more likely, but the interpretation expressed by (3*) (or something similar) is also possible. From the statement in (4), it cannot be judged if the complication in question results from the existence of these degrees of freedom or from some property that they possess. With a literal interpretation of (5), it seems that the reason that "this quantity" vanishes is somehow indirectly related to the equation "$\theta_n = 2^n$," but it is more likely that its vanishing is a direct consequence of this relation. (Further examples of this type are considered in the next section.)

26.2.2 Problem of awkwardness

The following demonstrate a problem that differs from that seen in the above examples.

(6) However, the distributions for these quantities are similar because of the sameness of their spin dependence.
(6) However, the distributions for these quantities are similar because they have the same spin dependence.
(7) Such processes are allowed because of the non-local property of this

effect.

(7) Such processes are allowed because this effect is non-local.

(8) However, the total energy is not conserved because of the virtuality of the initial e^+ and e^-.

(8) However, the total energy is not conserved because the initial e^+ and e^- are virtual.

(9) The above conditions are violated in the present case because of the lack of mass and self-interaction terms.

(9) The above conditions are violated in the present case because there are no mass and self-interaction terms.

(10) Because of the non-vanishing of Eq. (6.9), the second-order perturbation term yields the following:

(10) Because Eq. (6.9) is non-vanishing, the second-order perturbation term yields the following:

(11) A Milnor attractor is not an attractor in conventional sense, because of the presence of unstable directions.

(11) A Milnor attractor is not an attractor in conventional sense, because it possesses unstable directions.

To understand the difference between the problem considered presently and that considered with regard to (1)–(5), it is useful to compare (6) with (1). In the present case, although the original sentences do contain enough information to express the intended meanings, the misuse of "because of" results in very awkward statements. The problem with the above sentences is that in order to present all the information necessary to convey the intended ideas, cumbersome noun phrases have been constructed to act as the objects of "because of." These noun phrases are as follows: in (6), "the sameness of their spin dependence"; in (7), "the non-local property of this effect"; in (8), "virtuality of the initial e^+ and e^-"; in (9), "lack of mass and self-interaction terms"; in (10), "the non-vanishing of Eq. (6.9)"; in (11), " presence of unstable directions." In the rewritten forms, the use of such unnatural objects has been avoided by changing the prepositional phrases to clauses.

26.3 Misused to express a direct causal or logical connection

Although the preposition *because of* can be used to express causal and logical connections, in the case that such a connection is very direct, there are more appropriate expressions. One example of this type of misuse was seen in (5) of the previous section. Below I give further examples.

(1) This sudden drop in temperature is because of the change in volume.

(1) This sudden drop in temperature /is due to/is caused by/results from/ the change in volume.

(2) At a higher concentration, the membrane becomes flat because of the large effective bending coefficient.

(2) At a higher concentration, the membrane becomes flat as a result of

the large effective bending coefficient.
(3) It is pointed out in Ref. [8] that the free volume of the QD is reduced because of the dead-layer effect of the exciton.
(3) It is pointed out in Ref. [8] that the free volume of the QD is reduced /as a result of/through/by/ the dead-layer effect of the exciton.
(4) The fact that q_λ is a compact map on $K_1^0(\Sigma)$ is because of the compactness of T.
(4) The fact that q_λ is a compact map on $K_1^0(\Sigma)$ is due to the compactness of T.
(4*) The compactness of the map q_λ on $K_1^0(\Sigma)$ follows from the compactness of T.
(5) The system changes because of the antigen invasion.
(5) The system changes as a result of the antigen invasion.
(6) The 'bifurcation diagram' is distorted because of the averaging process.
(6) The 'bifurcation diagram' is distorted by the averaging process.
(7) A nonzero magnetic moment appears because of this transition.
(7) A nonzero magnetic moment appears /through/as a result of/ this transition.
(8) Their contributions to the Lagrangian vanish because of the $d^4\theta$ integration.
(8) Their contributions to the Lagrangian vanish under the $d^4\theta$ integration.
(9) This interesting behavior is because of the noise patches.
(9) This interesting behavior is due to the noise patches.
(10) This peak is because of an excitation of the quasinormal modes.
(10) This peak is due to an excitation of the quasinormal modes.

The use of "because of" in the original sentences here is inappropriate because it does not properly express the close and direct connections intended. The expressions used in place of "because of" more clearly express that the results in question follow directly and as natural consequences of the stated causes or that the conclusions in question follow through direct logical inference from the stated premises.

Now, contrast the above sentences with the following, in which the connections between the causes and results are not so direct.

(11) Special care is necessary for measurement of the cross sections at forward angles because of the difficulty involved in current integration.
(12) We used a plastic scintillating fiber because of its handling ease.
(13) The numerical integration of the equations of motion was performed with the leapfrog algorithm because of its simplicity.
(14) Because of the special nature of the scaling law, this situation should exist even for vanishingly small values of K.
(15) Because of its complexity, however, their method becomes cumbersome at higher orders.
(16) Such systems have been studied intensively because of both their scientific and engineering importance.

(17) These effects warrant more detailed investigation because of their universal nature.

In these sentences, the somewhat indirect logical connections are expressed naturally by "because of."

26.4 Problem of missing information

In Section 2, we considered misuses of *because of* in which insufficient information is presented by the prepositional phrases it is used to introduce. There, the problem was solved by changing these prepositional phrases to clauses that contain the lacking information. The examples below illustrate situations in which this problem of missing information can be solved in other ways.

(1) Because of these distributions, we call u_+ a "climbing state" and u_- a "descending state."
(1) Because of the forms of these distributions, we call u_+ a "climbing state" and u_- a "descending state."
(2) This unusual behavior is because of the potential in this case.
(2) This unusual behavior is due to the nature of the potential in this case.
(3) Because of fractal basin boundaries, long chaotic transients appear before the system falls into a periodic orbit.
(3) Because of the fractal nature of the basin boundaries, long chaotic transients appear before the system falls into a periodic orbit.
(4) There appear no massless Nambu-Goldstone bosons because of the mechanism in this vacuum.
(4) There appear no massless Nambu-Goldstone bosons because of the nature of the mechanism in this vacuum.
(5) This new scale arises because of the localized graviton.
(5) This new scale arises because of the existence of the localized graviton.

In each of the original sentences here, the object of the preposition "because of" alone does not contain sufficient information to express the intended meaning. For example, in (1), it is unclear what it is about these distributions that leads us to use the names "climbing state" and "descending state." In fact, linguistically, the most natural interpretation of this sentence is that we use these names simply because these distributions exist. However, apparently the intended meaning is that the "forms" of the distributions are what lead us to use these names. As the above examples demonstrate, the type of problem studied here can often be solved by adding the noun *existence* or *nature* or a noun referring to the appropriate property or feature of the thing under consideration.

Chapter 27

beside and *besides*

Beside can be used as a preposition with the meanings of *in addition to* and *except for*.[1] *Besides* can be used as a preposition with the same meanings, and it can also be used as an adverb with the meanings of *in addition*, *moreover* and *otherwise*. However, in formal written English, it is best to avoid such uses of these words, because they are somewhat informal and, more importantly, because they can lead to ambiguity.[2] The following illustrate expressions that can be used in place of *beside* and *besides*.

> (1) The QKZ equation can be formulated with the extended affine or double affine Hecke algebras, besides the Weyl groups.
> (1) The QKZ equation can be formulated with the extended affine or double affine Hecke algebras, /in addition to/as with/ the Weyl groups.
> (2) This led to the discovery of entropy as a state variable besides energy.
> (2) This led to the discovery of entropy as a state variable, like energy.
> (3) Beside this solution, there is a kink solution that propagates with a much larger speed.
> (3) In addition to this solution, there is a kink solution that propagates with a much larger speed.
> (4) This approach works well for the example considered below. Besides, with a slight alteration, it can be applied to the examples considered in Ref. [2].
> (4) This approach works well for the examples considered in this paper. /Moreover/In addition/Also/, with a slight alteration, it can be applied to the examples considered in Ref. [2].
> (5) This sudden change of γ, besides the large domains, is characteristic of such systems.
> (5) This sudden change of γ, /along with/like/accompanied by/in addition to/as well as/ the large domains, is characteristic of such systems.
> (6) This property, besides those described above, dictate that there can

[1] In its primary meaning, *beside* is synonymous with *next to* or *close to*. Such use is generally not problematic in any context, and we do not consider it in this chapter.

[2] As illustrated by the examples given in this chapter, *beside(s)* is usually not the best term to express the meanings of ... の他に, ... を除いて and その上.

be at most one strictly positive solution.
(6) This property, /together with/along with/in addition to/like/ those described above, dictates that there can be at most one strictly positive solution.
(7) However, this function is discontinuous at and infinite number of points. Besides, it is well-defined only for $y > 0$.
(7) However, this function is discontinuous at and infinite number of points. /Moreover/Furthermore/In addition/, it is well-defined only for $y > 0$.
(8) Besides the trivial solution, there is no solution that satisfies all of these conditions in this regime.
(8) /With the exception of/Other than/ the trivial solution, there is no solution that satisfies all of these conditions in this regime.

As demonstrated by the above examples, *beside* and *besides* can be used in many senses. They are used in (1), (2), (3), (5), (6) and (8) as prepositions and in (4) and (7) as adverbs to express a number of different meanings. Because these words possess such a wide variety of meanings, their use can result in a lack of clarity and sometimes ambiguity. This is the case in each of the original sentences above. These all, to varying degrees, require the reader to make more effort than necessary, as it first must be determined with what meaning "beside(s)" is being used. For this reason, it is better to use the more precise expressions appearing in the rewritten forms.

I end this chapter by explaining a grammatical problem in (6). The fact that the verb "dictate" is used in plural form in this sentence reflects a misunderstanding of the grammatical role of *besides* in connecting nouns. The author of this sentence apparently thought that, like *and*, *besides* connects nouns in a symmetric manner and, for this reason, that this sentence possesses a compound subject. However, nouns connected by *besides*, like those connected by *as well as*, *with*, etc., necessarily play different grammatical roles. In (6), "property" is the subject of the sentence, and "those" is the object of the preposition "besides."

Chapter 28

both

28.1 Misused to express a relationship between two things

The word *both* can be used as an adjective, a pronoun or a conjunction. Problems commonly arise when it is used in the first two of these roles.[1] Here I give a number of examples demonstrating such problems.

(1) Both of these terms agree.
(1) These two terms agree.
(2) Both of these terms cancel.
(2) These two terms cancel.
(3) Both the lensing and x-ray masses agree.
(3) The lensing and x-ray masses are /consistent/identical/.
(4) If the both of the mode functions obey the common boundary condition, we can easily compare their behavior.
(4) If the two mode functions satisfy the same boundary condition, we can easily compare their behavior.
(5) Both schemes are equivalent.
(5) The two schemes are equivalent.
(6) Both models give similar results.
(6) The two models give similar results.
(7) Both functions show similar forms.
(7) The two functions exhibit similar forms.
(8) There is a difference between the delay times for both sensors.
(8) There is a difference between the delay times for the two sensors.
(9) Treatments of the anomaly problem in both approaches are different.
(9) The treatments of the anomaly problem in the two approaches differ.
(10 This is, however, restricted to quantization of the neutral string with opposite charges at both ends.
(10) This is, however, restricted to quantization of the neutral string with opposite charges at either end.

[1] One source of these problems is the direct translation of 両. Although 両 can in many cases be translated as *both*, it in fact has a much broader range of uses.

The problem with the above original sentences is that they are intended to describe relationships between two things, but their uses of "both" imply something entirely different. In general, *both* is only appropriate when the statement regarding the two things it represents applies to each individually. Grammatically, this means that the action or state expressed by the verb applies individually to the two nouns to which the pronoun *both* refers or the adjective *both* modifies.[2] Thus, in particular, *both* cannot be used in statements describing the relationship between two things, as in (1)–(9). Assuming the proper use of "both," we could split each of these original sentences into two independent clauses without changing the meaning, for example, in the case of (1), as follows: *The first term agrees, and the second term agrees.* The meaning of this sentence is that there is some unnamed thing with which the first term agrees and some unnamed thing with which the second term agrees. In particular, this sentence does not express the intended meaning, that these terms agree *with each other*.[3] Again assuming the proper use of "both," (2) would express the same meaning as the following: *One term cancels, and the other term cancels.* However, the implication of this sentence is that these two terms cancel with some other terms, not with each other, which is the intended meaning. The situation is similar in each of the remaining original sentences. For example, the use of "both" in (8) implies that this can be split as follows: *There is a difference between the delay time for the first sensor, and there is a difference between the delay time for the second sensor.* Obviously, however, this does not describe the relation under consideration.

For comparison with the above, consider the correct uses of *both* demonstrated below.

> (11) Both of these predicted values are consistent with their experimental counterparts.
> (12) Both of the models exhibit behavior similar to that seen in real population systems.

In each of these sentences, the predicate ("are..." and "exhibit...") does not compare the two things corresponding to "both." Rather, it describes the relationship of each of these things individually with something else. Thus, in contrast to (1)–(10), here the intended meanings indeed can be expressed by splitting these sentences into two independent clauses. For example, in the case of (11), we have something like the following: *The first predicted value is consistent with its experimental counterpart, and the second predicted value is consistent with its experimental counterpart.*

28.2 Ambiguous use with negative expressions

Use of *both* with negative expressions usually results in ambiguity. This is illustrated by the following.

[2] In this sense, *both* is like *each* and *any* and unlike *every* and *all*.

[3] Note that there is also a problem with the use of "agree" in this sentence. A detailed treatment of such problems is given in Chapter 6.

(1) Both of these procedures are not well defined.
(1) Neither of these procedures is well defined.
(1*) At least one of these procedures is not well defined.

The two possible interpretations of the original are expressed by (1) and (1*).

The ambiguous use of *both* in negative expressions is discussed in greater detail in Chapter 8.

Chapter 29

by

In the papers I proofread, misconceptions regarding use of the preposition *by* are perhaps the single most common source of mistakes. There are many different ways in which this word is improperly used. Here I treat those that appear particularly often.[1]

29.1 Expressions of the form *[action]* + *by* + *[tool]*

29.1.1 Introduction

Use of *by* in phrases that express the performance of some action through the use of some kind of 'tool' (for example, a theory, an experiment, a calculational method, an investigational procedure, experimental apparatus) is extremely common among Japanese authors.[2] This problem is best addressed separately in two cases, passive sentences and active sentences.

In passive sentences

The problem with the presently considered use of *by* in passive sentences can be understood from the following.

> (1) The nature of this undulation was analyzed by the single-mode approximation.

The intended meaning here is that this analysis (the action) is performed using the single-mode approximation (the tool), but in fact, the meaning expressed is that the single-mode approximation itself performs the analysis. To understand this, we must study the grammatical structure of the sentence. The verb of (1) is the passive form "was analyzed." The problem here is that when the preposition *by* is used with a passive verb, the object of the preposition (here "approximation") represents the subject of the corresponding active sentence. Thus, corresponding to (1) we

[1]Many of the misuses of *by* considered here result from the mistaken translation of によって or で. It must be realized that the situations in which ... によって and ... で can be appropriately translated as *by*... are limited.

[2]For related discussion, see Chapter 33, Section 1.

would have the active sentence *The single-mode approximation analyzed the nature of this undulation.* This is quite different from the active sentence expressing the intended meaning, which is presumably the following: *We analyzed the nature of this undulation using the single-mode approximation.* We thus see that in the situation that a passive verb is used in a sentence describing some action, only the agent that carries out this action – **not** the tool used by this agent – can act as the object of the preposition *by*. To express the intended meaning, (1) should be rewritten as follows.

> (1) The nature of this undulation was analyzed using the single-mode approximation.

In active sentences

While the problem involved with the use of *by* in active sentences expressing the performance of an action through use of a tool is not as serious as that described above, in such situations too it should be avoided in favor of a more precise term like one of the following:[3] *(by) using*, *with*, *(by) employing*, *through*, *in terms of*, *by applying*, *(by) utilizing*, *(by) making use of*, *through use of*, *by means of*, *with the help of*, *with the aid of*, *from*. This is because, although *by* does possess the meanings of *with the use of* and *through the /agency/action/ of*, it possesses many other meanings as well, and for this reason its use in such situations usually results in imprecise and unnatural assertions.

Below I give a number of examples demonstrating in several contexts this type of problematic use of *by* in both passive and active sentences. In each case I offer one or more expressions to replace *by*. However, it should be kept in mind that the expressions given in any case are not necessarily the only 'correct' choices. In most cases I simply chose the few that, in my judgment, sound most natural.

29.1.2 When the tool is experimental apparatus

> (2) These results were confirmed by a second measurement device.
> (2) These results were confirmed using a second measurement device.
> (3) The patterns were observed by a specialized filter-amplification system.
> (3) The patterns were observed /using/by use of/with the aid of/ a specialized filter-amplification system.
> (4) The distances between lamellae were measured by an electron microscope.
> (4) The distances between lamellae were measured /with/using/ an electron microscope.

[3] I list these terms roughly in order of the frequency with which I use them in scholarly written work. It should also be kept in mind, however, that these vary significantly in meaning. (Indeed, this variation is due to their precision.) The following are some less frequently used expressions with similar meanings: *by agency of*, *through the agency of*, *by instrument of*, *by implementing*, *by implementation of*, *by utilization of*, *through resort to*, *by recourse to*, *through use of*, *with the use of*, *through the action of*, *by application of*.

In each of these cases, a person carries out the action in question, while the original sentences imply that the actions are carried out by some experimental apparatus.

Contrast the above examples with the following, in which the actions indeed are performed by the tools mentioned.

> (5) The data were taken by a scintillator counter and analyzed in real time by a dedicated computer that, in turn, controlled the threshold of the counter in accordance with results of this analysis.

29.1.3 When the tool is a method, procedure, etc.

> (6) This integral was performed by the Newman method.
> (6) This integral was performed /with/using/ the Newman method.
> (7) We measured the line width by a specialized technique by Watson.
> (7) We measured the line width /using/with/employing/with the aid of/by making use of/utilizing/ a specialized technique developed by Watson.
> (8) By the approach described above, we now attempt to solve Eq. (4.5).
> (8) /Using/With/ the approach described above, we now attempt to solve Eq. (4.5).
> (9) We compute χ by Schmidt's algorithm.
> (9) We compute χ /using/employing/ Schmidt's algorithm.
> (10) Such a computation can be carried out by the procedure described in Appendix A.
> (10) Such a computation can be carried out /by using/through/by employing/ the procedure described in Appendix A.

In (6), (8) and (10), the verb modified by the prepositional phrase "by..." ("was performed," "attempt," "can be carried out") represents an action performed by a person, but this use of "by" seems to imply that it is performed by the method in question. In (7) and (9), the misuse of "by" results in unnatural and imprecise statements.

Contrast the above with the following.

> (11) The calculation of σ is made much simpler by this method.

This use of "by" is correct because that which makes the calculation simpler indeed is the method. The example below presents a somewhat more interesting situation.

> (12) This theorem is proven by induction.

Comparing this with the previous examples, it may seem that it too is incorrect, since, in general, a person proves a theorem. In fact, however, there is no problem here, because the expression *induction proves this theorem* is indeed quite natural. In this sense, the logical method of induction is special, as even in mathematical contexts, in general, expressions asserting that some action is carried out by a method are problematic. For example, note that the meaning expressed by the active form of (6), *the Newman method performs this integral*, is very strange.

29.1.4 When the tool is an argument, calculation, etc.

(13) This is found by a Webber-like calculation.
(13) This is found /through/using/with/with the aid of/by making us of/ a Webber-like calculation.
(14) Light mirror nuclei are studied by shell model calculations.
(14) Light mirror nuclei are studied /using/by means of/with the aid of/utilizing/ shell model calculations.
(15) The proof of this theorem can be carried out by the argument appearing in Ref. [2].
(15) The proof of this theorem can be carried out /with/using/exploiting/with the aid of/making use of/ the argument appearing in Ref. [2].

The above examples, in which the action is carried out by a person, should be compared with the following.

(16) We are led by this argument to conclude that at most one of these solutions is observable.

Here, the "argument" does indeed lead us to the stated conclusion.

29.1.5 When the tool is a model

(17) Light mirror nuclei are studied by the shell model.
(17) Light mirror nuclei are studied /with/using/employing/ the shell model.
(18) This is the value obtained by our model.
(18) This is the value obtained /with/from/using/ our model.
(19) It is difficult to obtain consistent results by the present model.
(19) It is difficult to obtain consistent results /with/using/employing/ the present model.

Compare these with the following.

(20) We are allowed by this model to investigate both symmetric and asymmetric cases in the same manner.

29.1.6 When the tool is a mathematical object, operator or expression

(21) This analysis is carried out by the functions g_1 and g_2.
(21) This analysis is carried out /in terms of/using/with/employing/utilizing/by exploiting/with the aid of/by making use of/ the functions g_1 and g_2.
(22) We then compare the result with that obtained by the Woods-Saxon potential.
(22) We then compare the result with that obtained /using/employing/ the Woods-Saxon potential.
(23) The function $f(x)$ is fit by an exponential function.
(23) The function $f(x)$ is fit /using/with/to/ an exponential function.

(24) This can be rewritten by the dimensionless parameter $\tilde{q}$.
(24) This can be rewritten /with/using/in terms of/ the dimensionless parameter $\tilde{q}$.
(25) The functions $X_n(p)$ are expressed by functions of $X_\mu(p)$ and $X_\mu^*(p)$.
(25) The functions $X_n(p)$ are expressed in terms of the functions $X_\mu(p)$ and $X_\mu^*(p)$.
(26) This result can be obtained by the operator F.
(26) This result can be obtained by applying the operator F.
(27) The proof is then completed by Eq. (5.1).
(27) The proof is then completed by /noting/employing/ Eq. (5.1).
(28) The correct form is obtained by these three relations.
(28) The correct form is obtained /using/from/through application of/ these three relations.

Compare the above with the following.

(29) The final result is influenced little by the perturbing term.
(30) The quantity ξ is defined by the following equation:
(31) The order of these points is changed by the operator $\mathcal{T}$.
(32) This relation is expressed by (1.1).

In the situations described by these sentences, the actions in question indeed are carried out by the "term," "equation," "operator" and "(1.1)."

29.2 Misused in place of *[verb]* + *by* in attributing a result to a person

A second common type of mistake involving *by* is demonstrated by the following.

(1) For this purpose, it is convenient to use the theorem concerning rings of this type by Anderson.
(1) For this purpose, it is convenient to use the theorem concerning rings of this type /proven/obtained/demonstrated/ by Anderson.

When attributing a research result to a person, it is never sufficient to use *by* alone, in the manner demonstrated by (1). This misuse seems to result from the misguided analogy to the attribution of authorship, as in the following: *The Leviathan*, by Hobbes. In general, when identifying a person as the originator of a theory, the discoverer of some phenomenon, the developer of some method, etc., it is necessary to include the verb that describes what the person did in this regard, as illustrated in (1).

The following are typical examples of this type of misuse.

(2) This result, by Hobson, is quite revealing.
(2) This result, /obtained/derived/ by Hobson, is quite revealing.
(3) The method by Fujii is useful in the parabolic case.
(3) The method /introduced/formulated/constructed/ by Fujii is useful

in the parabolic case.
(4) The /method/theory/analysis/ by Chu can be applied to a wide range of systems.
(4) The /method/theory/analysis/ /introduced/originated/proposed/ constructed/formulated/ by Chu can be applied to a wide range of systems.
(5) The argument by Anderson is summarized below.
(5) Anderson's argument is summarized below.
(5*) The argument /given/made/ by Anderson is summarized below.
(6) The imaging observations by Ref. [2] are listed in Table 2.
(6) The imaging observations /of/reported in/presented in/ Ref. [2] are listed in Table 2.

29.3 Misused as a synonym of *as a result*, *due to* and similar expressions

By should not be used to identify the cause or source of some effect as illustrated by the following.

(1) The value of ω changes significantly by this perturbation.
(1) The value of ω changes significantly as a result of this perturbation.
(2) Such studies have become possible by developments in experimental techniques.
(2) Such studies have become possible /with/through/as a result of/ developments in experimental techniques.
(3) This type of behavior appears by the first of these bifurcations.
(3) This type of behavior appears /as a result of/through/following/upon/ the first of these bifurcations.
(4) In the long-time limit, the system becomes homogeneous by the diffusion term.
(4) In the long-time limit, the system becomes homogeneous /through the influence of/due to/ the diffusion term.

In each of the original sentences we have the following basic grammatical structure: *[noun 1] + [verb] + by + [noun 2]*. Here *[noun 1]* is something that undergoes change, and it is the subject of *[verb]*, which expresses this change. The intended meaning is that *[noun 2]* is the agent causing this change. However, it is not possible to express such a meaning using this kind of grammatical construction, because *by* simply does not possess the necessary meaning.

Let us compare the above with the following proper use of *by*, in which it does identify the agent causing change.

(5) The significant change in the value of ω is caused by this perturbation.

Here, the change undergone by *[noun 1]* (in this case "value") is not expressed by the verb of the sentence. Instead, this verb ("is caused") expresses the action carried

out by *[noun 2]* ("perturbation").[4] Thus this use of "by" is correct.

The following present even more serious problems than the above examples.

> (6) We consider microlensing events by binary lenses.
> (6) We consider microlensing events /created by/caused by/due to/ binary lenses.
> (7) The error by ignoring this term is negligible.
> (7) The error /introduced/caused/ by ignoring this term is negligible.

In these cases, the verb expressing the action performed by the object of the prepositional phrase "by..." is missing. Such constructions are erroneous. Note that in (6), these lenses correctly act as the subject of the actions of "creating" and "causing," and in (7), "ignoring this term" is correctly identified as the source of the actions of "introducing" and "causing."

29.4 Misused as a synonym of *as shown by*, *as seen from* and similar expressions

The following demonstrate a misuse of *by* that results in logically problematic assertions.

> (1) These functions are orthogonal by the following argument.
> (1) These functions are orthogonal, as shown by the following argument.
> (2) This value is slightly less than 10 by considering Eqs. (1.1) and (1.2).
> (2) This value is slightly less than 10, as can be seen by considering Eqs. (1.1) and (1.2).
> (2*) As seen from (1) and (2), this value is slightly less than 10.
> (3) This quantity vanishes in the $D = 1$ case by making use of certain properties of Γ matrices.
> (3) This quantity vanishes in the $D = 1$ case, as can be demonstrated by making use of certain properties of Γ matrices.
> (4) By the method presented above, the Lagrangian $\mathcal{L}$ has the form $\int D[l(x)]\mathcal{F}[l]$.
> (4) With the method presented above, it can be shown that the Lagrangian $\mathcal{L}$ has the form $\int D[l(x)]\mathcal{F}$.
> (4*) With the method presented above, the Lagrangian $\mathcal{L}$ can be shown to have the form $\int D[l(x)]\mathcal{F}$.

In each of the original sentences here, the assertion attributes the cause of some situation to something that logically cannot be the cause. For example, (1) implies that the cause of the functions being orthogonal is the "following argument." The intended meaning, that this argument demonstrates (rather than causes) the orthogonality, is correctly expressed by the phrase "as shown by" in (1). Similarly, (2) seems to suggest that the fact that the value in question is slightly less than

[4] Note that this is a passive sentence and that "perturbation" is indeed the subject of the corresponding active sentence: *This perturbation causes the significant change in the value of ω.*

10 results from our considering "Eqs. (1.1) and (1.2)." As (2) and (2*) make clear, however, that which results from our considering these equations is our ability to "see" that this is the case. The third and fourth examples are similar.

29.5 Misused in expressions describing expansions

In mathematical usage, when describing an expansion, *by* should not be used to introduce the quantities in terms of which the expansion is expressed. This is illustrated by the following.[5]

> (1) It is known that the partition function Z has an expansion of the above form by using the counting functions.
> (1) It is known that the partition function Z has an expansion in the counting functions of the above form.
> (1*) It can be shown by using the counting functions that the partition function Z has an expansion of the above form.
> (2) This function is expanded by powers of ϵ.
> (2) This function is expanded in powers of ϵ.
> (3) In this regime, Ψ can be written in expanded form by $u - u_0$ and $v - v_0$.
> (3) In this regime, Ψ can be written in expanded form in /terms of/powers of/ $u - u_0$ and $v - v_0$.
> (4) In this case, the result can be most easily obtained if we first expand ψ by Legendre polynomials.
> (4) In this case, the result can be most easily obtained if we first expand ψ in Legendre polynomials.

In situations like this, such expressions as *in*,[6] *in terms of*, *in powers of* and *in orders of* are possible. In no case, however, can *by* be used in this role.

29.6 Misused with *reason*

By cannot be used with *reason* in the manner illustrated by the following.

> (1) This claim can be made by the following two reasons.
> (1) This claim can be made for the following two reasons.
> (1*) This claim can be demonstrated using the following two considerations.
> (2) The sufficiency of this simplified treatment is demonstrated by a simple reason.
> (2) The sufficiency of this simplified treatment is demonstrated by a simple argument.
> (2*) There is a simple reason for the sufficiency of this simplified treatment.

[5] In fact, this is another example of expressions of the form *[action] + by + [tool]*, but I consider this separately because of its very specific nature.

[6] More specifically, this becomes *in + [plural noun]*, where *[plural noun]* explicitly identifies the quantities in terms of which the expansion is written (e.g., basis functions, derivatives).

(3) This occurs by a reason that is explained below.
(3) This occurs for a reason that is explained below.

The problems in (1) and (2) are similar. In (1), the implication is that the reasons themselves make the claim in question, while, in fact, a person makes this claim on the basis of these reasons. Similarly, (2) asserts that the reason demonstrates the "sufficiency," whereas, actually, it provides the basis for the argument that gives this demonstration. The problem with (3) is somewhat different. In this case, "by" is simply being misused in place of *for*.[7]

29.7 Misused in citations

It is usually inappropriate to use an expression indicating citation as the object of the preposition *by*. The problem involved in this usage can be seen from the following.

(1) The imaging observations by Ref. [2] are listed in Table 2.
(1) The imaging observations /of/reported in/ Ref. [2] are listed in Table 2.
(2) As pointed out by Ref. [5], these effects are important.
(2) As pointed out in Ref. [5], these effects are important.
(2*) As pointed out by the authors of Ref. [5], these effects are important.

In (1), it is suggested that the paper "Ref. [2]" itself made the "imaging observations," while (2) asserts that "Ref. [5]" points out the importance in question. Clearly, however, in both cases, it is people who do these things.

[7] This problem is similar to that involving *because of* treated in Chapter 26, Section 1. For other related discussion, see Chapter 108.

Chapter 30

call

When the verb *call* is used with the meaning of *refer to as*, it must be used in the following manner: *We call A B*. Here, A is the direct object, which is the thing that is being named, and B is the complement, which acts as the name. The main point here is that there are no words between A and B. I often find misuse of *call* in which a preposition is used between its direct object and complement. The following are typical examples.

(1) We call this as the internal mode.
(1) We refer to this as the internal mode.
(1*) We call this the internal mode.
(2) If H is of degree q and the curve S is of genus l, then $[F, S]$ is called of degree q and genus l.
(2) If H is of degree q and the curve S is of genus l, then $[H, S]$ is said to be of degree q and genus l.
(2*) If H is of degree q and the curve S is of genus l, then we say that $[H, S]$ is of degree q and genus l.

The difference between *call* and *refer* as used in (1*) and (1) is that the former is a transitive verb and the latter is an intransitive verb.[1] In (1), the indirect object of "refer" is "this." Here, "as the internal mode" is a prepositional phrase that acts as an adverb, modifying "refer." In (1*), "this" is the direct object, and "mode" is the complement of "call." The problem with (1) is that the word that should be the complement is instead acting as the object of the preposition "as." The result is a meaningless sentence.[2]

A similar problem is demonstrated in (2). To understand this, it is best to consider the active form of the second clause: *...then we call* $[F, S]$ *of degree* q *and genus* l. Thus we see that, as in (1), there is a prepositional phrase ("of degree q and genus l") playing the role of the complement. This is grammatically impossible.[3]

[1] A transitive verb takes a direct object (for example, *derive*), while an intransitive verb does not (for example, *diverge*).

[2] While we can use a prepositional phrase *as...* to modify the verb *call*, such a construction does not express the name by which something is being called but, rather, the manner in which it is being called this name. For example, we can say *I called her 'my dear' as a friend.*

[3] A complement can only be either a noun or an adjective.

In contrast to (1), however, in the present case, the intended complement is not the object of the preposition, and therefore we cannot solve the problem by simply deleting the preposition "of." Here the problem is with the verb "call." This problem is remedied in (2) and (2^*). In (2^*), the entire clause[4] "that $[H, S]$ is of degree q and genus l" forms the direct object of the verb "say." Within this clause, the prepositional phrase "of degree q and genus l" acts as an adverb, modifying the verb "is." Note that (2) is the passive version of (2^*).

[4]This is called a noun clause.

Chapter 31

candidate

The noun *candidate* is often used by Japanese authors in reference to something that, based on present knowledge, possibly plays or is capable of playing a certain role or possibly has a certain identity. This usage is usually problematic and should be avoided.[1] There are several closely related ways in which this word is misused with such a meaning, as considered below.
Possible source, cause of an object, phenomenon

(1) Dark matter could be a good candidate for the source of this effect.
(1) It is quite possible that dark matter is the source of this effect.
(1*) It seems quite likely that dark matter is the source of this effect.
(1**) Dark matter cannot be ruled out as the source of this effect.
(1***) There is a significant possibility that dark matter is the source of this effect.
(2) There are several candidates for the cause of this anomalously long-lived correlation.
(2) There are several possible causes of this anomalously long-lived correlation.
(2*) There are several possibilities for the cause of this anomalously long-lived correlation.
(3) With the above selection criteria alone, five events remain as candidate events for the process $K^-p \to \Xi^{*-}K^+$ followed by $\Xi^{*-} \to \Xi^-\pi^0$.
(3) Considering the above selection criteria alone, there are five events that could be responsible for the process $K^-p \to \Xi^{*-}K^+$ followed by $\Xi^{*-} \to \Xi^-\pi^0$.

Possible identity of an object, phenomenon

[1] Apparently, the problem here results from direct translation of 候補. It is necessary to realize that both the meaning and realm of suitability of 候補 are much broader than those of *candidate*. For example, the sentences
このような現象は、τが十分大きくなると必ず現れる。その原因について、先ず候補に挙げられるのは、AとBである。
would best be translated as something like the following: *This kind of phenomenon necessarily appears when τ becomes sufficiently large. We regard A and B as possible causes.*

(4) These solutions are $g = 0$ and $\eta = 2 - d$. The first solution corresponds to the Gaussian fixed point and the second is the candidate of the non-Gaussian fixed point.
(4) These solutions are $g = 0$ and $\eta = 2 - d$. The first solution corresponds to the Gaussian fixed point and the second is one /might correspond/likely corresponds/apparently corresponds/ to the non-Gaussian fixed point.
(5) Candidates for the Lambda particle among all the particle tracks were selected by requiring that $m_{\mathrm{V}} - m_{\Lambda}$ be less than 70 MeV/c^2.
(5) Identification of possible Lambda particle tracks among all the particle tracks was made by requiring that $m_{\mathrm{V}} - m_{\Lambda}$ be less than 70 MeV/c^2.
(5*) Identification of those tracks that could have been created by the Lambda particle was made by requiring that $m_{\mathrm{V}} - m_{\Lambda}$ be less than 70 MeV/c^2.
(6) This function is a candidate for the ground-state eigenfunction.
(6) This function /may be/might be/is possibly/ the ground-state eigenfunction.

Possible system displaying certain phenomena

(7) Clearly, any planet with all these conditions is a strong candidate for possessing life.
(7) Clearly, any planet with all these conditions is likely to possess life.
(8) As a candidate to observe this type of peak structure, we select ^{136}Xe, ^{116}Sn and ^{112}Cd targets.
(8) As targets that may allow for the observation of this type of peak structure, we select ^{136}Xe, ^{116}Sn and ^{112}Cd.

Possibly effective model of certain phenomena

(9) It has been considered that string theories are plausible candidates to govern physics at the Planck scale.
(9) It has been /suggested/asserted/ that string theories may describe physics at the Planck scale.
(10) A good candidate has been suggested recently to explain this peculiar resonance phenomenon.
(10) A recently proposed mechanism may be capable of accounting for this peculiar resonance phenomenon.
(10*) A recently proposed theory may be capable of /describing/providing a description/ this peculiar resonance phenomenon.
(11) This mechanism is the most attractive candidate to solve the strong CP problem in QCD.
(11) Among currently known possible mechanisms, this is the most likely to solve the strong CP problem in QCD.
(12) These theories will be good candidates to describe physics beyond the Standard Model.
(12) These theories may provide a description of physics beyond the Standard Model.

(13) The candidates for the field strength constructed from these extended covariant-derivative operators are the following:
(13) Possible forms of the field strength constructed from these extended covariant-derivative operators are given by the following:
(14) This approach is a candidate for quantum gravity.
(14) It is believed that this approach may allow for the construction of a theory of quantum gravity.

Possible method for obtaining a certain result

(15) One possible candidate to check our prediction is to simply compare the oscillatory reaction dynamics in stem cells and differentiated cells.
(15) One possible method to check our prediction is to simply compare the oscillatory reaction dynamics in stem cells and differentiated cells.
(16) Determining the change undergone by the gene expression pattern is also a possible candidate to check our theory.
(16) Determining the change undergone by the gene expression pattern is also a possible way to check our theory.
(17) A method based on that used by Austi may be a candidate for providing a proof of this assertion.
(17) A method based on that used by Austi may provide a proof of this assertion.
(18) This fact implies that setting $\gamma = 0$ for all k is the candidate of the first approximation.
(18) This fact implies that setting $\gamma = 0$ for all k may represent a first approximation.
(19) There are several ways to choose the vacuum, and the following two may be candidates that coincide in the limit $x^L \to x^R$:
(19) There are several ways to choose the vacuum. The following are two that may coincide in the limit $x^L \to x^R$:

There are many problems with the above uses of "candidate." To begin with, let us consider the obvious ones. First, to state that something is a candidate implies only that it may be realized as the thing in question. Thus, use of *candidate* with words like *may*, *possible*, *could* and *seem*, which have tentative connotations, is redundant. Such problems are seen in (1), (15) and (17). Second, *candidate* should not be used with a future tense verb, as in (12), because, in most situations, to state that X will be a candidate for Y in the future implies that it already is such a candidate.

Now let us discuss the more subtle problems with the above examples. The noun *candidate* is most naturally used in the situation that there exists a finite set of well-defined entities among which, with certainty, one (or perhaps more) will eventually be realized in the capacity in question. In addition, there is the implication that such things are 'candidates' by virtue of being so recognized by some group or individual with the authority to grant such recognition. For this reason, the types of usage illustrated by (1), (2) and (9)–(14) are especially problematic. In particular, let us examine (1) and (12).

The implication of (1) is that dark matter is one of a finite number of possible sources of the effect in question and that these are possible sources because they have been somehow 'officially' recognized as such. The image it creates is that there exists a distinctly specified 'candidate set' whose clearly defined elements represent all the possibilities for the mentioned source. It also suggests that the potentiality characterizing these 'candidates' is somehow an intrinsic property they possess and that the eventual realization of one of them as the 'true' source is something that we (or the 'authoritative experts') decide. The obvious problems here, however, are that, first, this potentiality is not a property of these 'candidates' themselves, but simply a theoretical manifestation of our insufficient knowledge, second, our decision does not realize the 'true' source, and, third, it is quite possible that the actual source is something that we have not yet identified.

The problems with (12) are similar. The implication of this sentence is that there are several (officially recognized) theories that potentially describe the class of phenomena in question, and that at some later time one of them will be realized as such. Again, there are three apparent problems with this. First, in any such situation, it is certainly possible that in fact none of the existing theories provides such a description. Second, this seems to imply that there is only one possible 'right' theory and that our job as scientists is to identify it among this finite set of candidates. Clearly, this is far from the actual situation we face in modeling physical phenomena. Third, the ability of any such theory to describe the phenomena in question is not something that we decide. We can attempt to discover the relation between a theory and the physical systems it is meant to describe, but we do not bestow this relation upon the theory through our inquiry. Thus, the idea that the capability or incapability of a theory comes into being through our study of it, as expressed by this use of "candidate," is unrealistic. Of course, there are situations in which our study of a theory involves its improvement. In such cases, however, rather than stating that this developing theory is a 'candidate' for describing some physical system, it is better to state that some future form of this theory may be capable of providing such a description. For example, consider the following.

> (20) This theory is still in a primitive form, and its descriptive ability is yet to be realized. For this reason, and considering the success it has had in describing certain simple systems, we regard it is a candidate to describe physics below the Planck scale.

The intended meaning here is much more naturally expressed by changing "regard...describe" to something like one of the following: *believe that a future form of this theory may be useful in describing*, *believe that some future form of this theory may be capable of describing*, *believe that some future form of this theory may provide a description of.*

Chapter 32

categorize and *classify*

There seems to be some widespread confusion among Japanese scholars regarding the use of the verbs *categorize* and *classify*.[1] In the following sections I treat their most common types of misuse.

32.1 Misuse with *by*

The following examples are typical of the misuse of *categorize* and *classify* with the preposition *by*.[2]

(1) These vertices are categorized by their internal angles.
(1) These vertices are categorized /according/with respect/ to their internal angles.
(2) The events were categorized by the topology of charged particle tracks.
(2) The events were categorized /with respect/according/ to the topology of charged particle tracks.
(3) The solutions of the Lamé equation with $\phi(u + 2K(k)) = \pm\phi(u)$ are known to be classified by the four types of the eigenfunctions, $Ec_N^{2n}(u, k)$, $Ec_N^{2n+1}(u, k)$, $Es_N^{2n+2}(u, k)$ and $Es_N^{2n+1}(u, k)$.
(3) The solutions of the Lamé equation with $\phi(u + 2K(k)) = \pm\phi(u)$ can be classified in terms of the four types of eigenfunctions, $Ec_N^{2n}(u, k)$, $Ec_N^{2n+1}(u, k)$, $Es_N^{2n+2}(u, k)$ and $Es_N^{2n+1}(u, k)$.
(4) The SU(6) multiplets are classified by the representations of the spin-flavor group SU(2)×SU(3).
(4) The SU(6) multiplets are classified /in terms of/with respect to/in reference to/ the representations of the spin-flavor group SU(2)×SU(3).
(5) In Fig. 4, the states of the system are classified by the ratio of the

[1] All of the discussion given here also applies to the verb *group*, whose meaning is very similar to those of *categorize* and *classify*. However, because the types of mistakes I consider here appear much less frequently with this word, I do not treat it explicitly.

[2] Note that the mistaken use of *categorize* and *classify* with *by* is an example of the problem discussed at length in Section 1 of Chapter 29. This misuse seems to result from the inappropriate translation of によって or で as *by*.

area of vesicle regions.
(5) In Fig. 4, the states of the system are classified /according/with respect/ to the ratio of the area of vesicle regions.

The problem in each of these sentences can be understood from (1). Note here that if we change this from passive to active form, we have the following: *The internal angles of these vertices categorize them.* Thus, the subject of "categorize" is "angles." This, however, describes an unfeasible situation. In general, that which can act as the subject of *categorize* or *classify* is only the agent that decides the categorization or classification – usually a human. The misunderstanding of this point seems to be the cause of the presently considered misuse. In the examples above, the most natural such agent is *we*. For this reason, the use of "by" in all cases is inappropriate.

32.2 Misuse with other words

(1) These elements are categorized depending on their orientation.
(1) These elements are categorized /with respect/according/ to their orientations.
(2) The operators are classified with the same reflection symmetries of their eigenfunctions.
(2) The operators are classified /in reference/with respect/according/ to the reflection symmetries of their eigenfunctions.
(3) Baryon states with *uds* flavors are categorized in the counting scheme of the DOQ model.
(3) Baryon states with *uds* flavors are categorized /with respect to/according to/using/ the counting scheme of the DOQ model.
(4) Next, we classify the convergence behavior of the potential in three types: $\alpha > 1$, $\alpha = 1$ and $\alpha < 1$.
(4) Next, we classify the convergence behavior of the potential into three types, for $\alpha > 1$, $\alpha = 1$ and $\alpha < 1$.

Misuse of *categorize* and *classify* with *depending*, as exemplified by (1), is quite common. In general, these words cannot be used together in this way.

A phrase of the form *A is /classified/categorized/ with B*, like that in (2), means that A and B are the same type of thing and that they are placed in the same class or category. The proper use of such a phrase is demonstrated by the following.

(5) In the context of the present approach, Eq. (1) is classified with Eq. (2), because for each solution of either equation, there is an element of S that transforms it into a solution of the other.

The use of "in" in (3) is somewhat imprecise. The intended meaning here is that the categorization is carried out in accordance with this scheme, but the original could be interpreted as implying a more indirect relationship – that the categorization is somehow carried out within the context of this scheme, according to some unspecified rule.

In (4), "in" is simply misused in place of "into." Also note here that the original is strange in that it implies that the relations "$\alpha > 1$," "$\alpha = 1$" and "$\alpha < 1$" are "types," when in fact they designate the different values of α characterizing these types, as is made clear by (4).

32.3 Misrepresenting a relationship with *into*

As demonstrated by (4) in the previous section, we can use the preposition *into* along with *categorize* or *classify*. The following are further examples.

> (1) f is categorized into S.
> (2) The surfaces τ_i are classified into the classes Σ^+ and Σ^-, according to the sign of their curvature at the origin.

The meaning of (1) is that S forms a category of some kind, and f is a member of this category. In (2), Σ^+ and Σ^- are classes whose elements are the surfaces τ_i. The most important point to keep in mind when using *into* in this manner is that its object (in the above, "S" and "Σ^+ and Σ^-") represents something of a completely different nature than those things that are being categorized, namely, the category or categories in question. Particularly common among the types of mistakes involving *into* is that in which the thing represented by the object of this preposition and the things being categorized are of the same type or play the same type of role. The resulting sentence describes an impossible situation.

The following illustrated typical mistakes involving *categorize*/*classify* and *into*.

> (3) Several distinct models on this level can be categorized into the same static O-R model.
> (3) Several distinct models on this level can be regarded as /corresponding to/representing/ the same static O-R model.
> (3*) Several distinct models on this level can be thought of as belonging to the class of a single static O-R model.
> (4) CuCl nanocrystals are typically classified into the material in the exciton confinement regime.
> (4) CuCl nanocrystals are typically /regarded/classified/ as belonging to the exciton confinement regime.
> (4*) CuCl nanocrystals are typically classified into the group of materials in the exciton confinement regime.
> (5) This type of game can be categorized into the second type of social dilemma.
> (5) This type of game exemplifies the second type of social dilemma.
> (6) We can clearly distinguish two families among the profiles of the flows, which are classified into "Type I" and "Type II."
> (6) We can clearly distinguish two families among the profiles of the flows, which we refer to as "Type I" and "Type II."
> (7) It follows from the first equation that the asymptotic behavior of a solution to this PDE can be classified into two types of steady state solutions.

(7) It follows from the first equation that the asymptotic behavior of a solution to this PDE can be classified into one of two types, corresponding to the two steady state solutions.
(7*) It follows from the first equation that the asymptotic behavior of a solution to this PDE corresponds to one of two types of steady state solutions.
(7**) It follows from the first equation that a general solution to this PDE converges to one of two steady state solutions.
(8) Examining the vesicle-like shapes, we classified the various states found in the simulations into two characteristic states, undulating lamellar and multilayered vesicular.
(8) Examining the vesicle-like shapes, we classified the various states found in the simulations into two characteristic types, undulating lamellar and multilayered vesicular.

The implication of (3) is that a "static O-R model" is a class whose elements are "models at this level." While the intended meaning here is not difficult to guess, this sentence itself expresses an improper relationship. Strictly interpreted, the implication of (4) is that "material" is a class of material. If we are to use "into" here, its object can only be something whose elements are types of materials, as demonstrated by (4*). Example (5) is very strange, because the "second type of social dilemma" is obviously not a class of games. In (6), the action in question is not a classification but simply a naming. Note that (7) is somewhat different from the previous examples. It may seem that this is a correct use of "into" because here its object is "type." The problem, however, is that the elements of this "type" are not instances of asymptotic behavior but, rather, steady state solutions. While the situation being described here is apparently one in which the solutions to this PDE converge to steady state solutions, it is not correct to say that the asymptotic behavior *is* a steady state solution. Such an assertion incorrectly equates a solution with its behavior. While this may seem to be a fine point of semantics, it is this type of imprecise expression that results in poor style. Clearly, (8) is similar to (4).

32.4 Proper uses

Below I present several additional sentences demonstrating proper uses of *categorize* and *classify*.

(1) We categorized all the 2,148 interaction events with respect to their event topologies.
(2) The eigenstates of H can be classified according to the total angular momentum, L, its z component, L_z, and one additional quantum number.
(3) Otherwise, we classify such a solution as pathological.
(4) We consider the parton distributions given by the two- and three-particle operators and classify them with respect to twist, spin dependence and chiral properties.

(5) We classify stationary stochastic processes into two types, temporally uncorrelated and temporally correlated.

Chapter 33

cause, make, allow, let

There are a number of ways in which the verbs *cause*, *make*, *allow* and *let* are misused. In this chapter I consider some of these.

33.1 Confusion of *make/cause* with *let/allow*

The causative verbs *make/cause* and *let/allow* are often confused by Japanese authors.[1] The point to keep in mind in using these verbs is that *cause* and *make* imply compulsion or force, while *let* and *allow* imply permission or non-interference. Thus the former have an active connotation, while the latter have a passive connotation. The differences in their usage are demonstrated by the following.

> (1) Decreasing the volume by δV lets the temperature increase by δT.
> (1) Decreasing the volume by δV causes the temperature to increase by δT.
> (2) Replacing the constraint $\sum_i \rho_i = \Omega$ by $\Delta \sum_i \rho_i < \Omega/\sigma$, however, causes the system to relax without a large symmetry-changing fluctuation.
> (2) Replacing the constraint $\sum_i \rho_i = \Omega$ by $\Delta \sum_i \rho_i < \Omega/\sigma$, however, allows the system to relax /without/in the absence of/ a large symmetry-changing fluctuation.

The problem with "let" in the first example is that it implies that this change in the volume only *allows the possibility* of a temperature increase. However, in fact this increase of temperature would appear to result directly and necessarily from the change of volume. In the second example, the situation is much different. Here, the change of the constraint does indeed only allow for the possibility of such relaxation. The mechanism causing the relaxation is something completely different from this change, which only makes it possible for this mechanism to become effective. The meaning of (2) is that changing the constraint in the stated manner forces the system to relax in such a manner that there is no large symmetry-changing fluctuation. The intended meaning, however, is that this change allows the system to relax in the

[1] I believe this results from the fact that there is only one causative form in Japanese. (Thus, the simplest translations of *I made him work* and *I let him work* are both 私は彼を働かせた.)

situation that there is no large symmetry-changing fluctuation. This is the meaning expressed by (2).

33.2 Other types of misuse

33.2.1 Misused with regard to behavior of the subject

In general, the verbs considered in this chapter are used in the situation that their subject exercises some influence or specifically does not exercise some influence, and through this influence or lack thereof, the behavior of some *other* thing is changed. These verbs are usually not appropriate in the case that the behavior in question is that of the subject itself. The following demonstrates a misuse of this kind.

> (1) We consider the evolution of the chemical species concentrations, which allows for non-linear oscillations.
> (1) We consider the evolution of the chemical species concentrations, which exhibits non-linear oscillations.

In the original, the subject of "allows" is "that,"[2] which refers to "evolution." This use of "allows" is inappropriate, because these oscillations are not something that the evolution controls or has some influence on. Rather, they form part of the evolution itself.

33.2.2 Missing direct object

The following illustrates a grammatical mistake.

> (2) This allows to construct an on-shell state.
> (2) This allows us to construct an on-shell state.
> (2*) This allows construction of an on-shell state.

All of the verbs we consider in this chapter are transitive, meaning that they take a direct object. In (2) the direct object of "allows" is "us," while in (2*) it is "construction."

33.2.3 Missing *to be* with *cause*

The following illustrates a quite common mistake.

> (3) We wish to determine the nature of the process that causes the lower peak of the momentum curve in this case.
> (3) We wish to determine the nature of the process that causes the peak of the momentum curve to be lower in this case.

The first sentence here seems to express the meaning that the process in question **creates** this peak. It apparently describes the situation that, for example, there are two peaks, a higher one and a lower one, and the existence of the lower one

[2] Here, "that" is a relative pronoun, and it introduces a relative clause.

is due to this process.[3] The intended meaning, however, as expressed by (3), is that this process causes a pre-existing peak to become lower. In grammatical terms, the problem here is that the intended meaning expressed by the pattern *[subject] + causes + [direct object] + to be + [adjective]* is mistakenly written *[subject] + causes + [adjective] + [direct object]*. The meanings expressed by these patterns are quite different. The latter expresses the meaning that *[subject]* causes *[direct object]* (which happens to have the characteristic described by *[adjective]*) to exist, while the former expresses the meaning that the pre-existing *[direct object]* is caused to change by *[subject]* in such a way that it can be described by *[adjective]*. The following are further typical examples.

> (4) The wave functions are thus pushed outward, which causes smaller level widths.
> (4) The wave functions are thus pushed outward, and as a result, the level widths become smaller.
> (4*) These wave functions are thus pushed outward. This causes the level widths to become smaller.
> (5) The existence of this symmetry causes a negative value of s.
> (5) The existence of this symmetry causes the value of s to be negative.
> (6) This effect causes the undulating distributions.
> (6) This effect creates the undulating distributions.
> (6*) This effect causes the undulation of the distributions.

It should be noted that for each of the original sentences, neither the meaning nor the problem would be changed if "causes" were replaced with *makes*. It should also be noted that *makes* cannot be simply substituted for "causes" in (3), (5) and (6*). In (3) and (5), this would yield a grammatical problem, as the construction *make + to + [infinitive]* is not possible (see Section 2.6 of this chapter). In (6*), this would result in a problem of meaning, because with such a change, the resulting meaning would be that the effect somehow 'constructs' the undulation. If *makes* replaced "causes" in (3) and (5) and "to be" were deleted, the resulting sentences would be grammatically correct, but they would be stylistically poor. In general, in written English, when the intended meaning can be expressed by *cause + to be + [adjective]*, it is best not to use *make* in place of *cause + to be*.

33.2.4 *cause* misused in regard to creation rather than change

The verb *cause* is more naturally used when the effect under consideration is a change in some pre-existing thing rather than the creation of some new thing.[4] More generally, it is very naturally used with any direct object that represents a process or action (for example, *cause an increase*, *cause a cascade*), but it usually cannot be used with a direct object that represents something of a different nature. The following use it typical.

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[3] If indeed this were the intended meaning, it would be better to change "causes" to *creates* or *produces*, as discussed in the next subsection.

[4] There are a number of exceptions (for example, *cause a problem* and *cause friction*) to this general guideline, however.

(7) Changing the boundary conditions in this manner causes θ to become negative.

Here, the effect caused by changing the boundary conditions is the change of θ.[5] Contrast this with the example below.

(8) Each of these permutations causes a multiplication by -1 in the exponent of β.
(8) Under each of these permutations, the exponent of β is multiplied by -1.

In this case, the original is unnatural, because the thing that is "caused" is the existence of a multiplication. Of course, there is an implied change here, but "multiplication" itself does not express this change. The following are further typical examples of this kind.

(9) In the present case, the configuration space has a nontrivial topology. This causes an ambiguity in the quantization of the theory.
(9) ...This /leads to/creates/ an ambiguity in the quantization of the theory.
(9*) ...This causes the quantization of the theory to become ambiguous.
(10) The interference between the two coherent vortices causes strong flow around the wing.
(10) The interference between the two coherent vortices /creates/results in/ strong flow around the wing.
(10*) The interference between the two coherent vortices causes the flow around the wing to become strong.
(10**) The interference between the two coherent vortices causes /strengthening/increased strength/ of the flow around the wing.
(11) The existence of this rigid structure causes a screening effect.
(11) The existence of this rigid structure creates a screening effect.

As seen here, in the situation that some effect leads to the existence of something, such expressions as *create*, *lead to* and *result in*[6] are usually better than *cause*. It should be noted that "causes" is used in (9*), (10*) and (10**) with regard to change, not creation.

33.2.5 Misuse of *make* to mean *cause*

Although *make* and *cause* are similar in meaning, the connotation of compulsion or forcing is much stronger for the former. In addition, when we use the verb

[5] The clause "θ to become negative" is an infinitive clause, which functions grammatically as a noun. Because infinitive clauses very often express actions, their use as the direct object of *cause* is quite common.

[6] The following are some additional expressions that possess similar meanings: *be the source of*, *bring about*, *bring into being*, *produce*, *generate*, *yield*, *engender*, *give rise to*, *originate*. With the grammatical roles of the of the two nouns in question changed, the following can also be used to express this type of meaning: *be due to*, *result from*, *arise from*, *emerge from*, *owe to*, *originate from*, *come from*, *be derived from*, *have as its source*.

make, it is somehow implied that the subject of the verb does not represent the direct cause of the change in question but, rather, the agent that enforces this change. Contrastingly, *cause* is usually used to express a more direct cause-effect relationship. For this reason, when such an expression is desired, *cause* is generally more appropriate. Consider the following.

(12) Therefore, deuteration makes the specific heat increase.
(12) Therefore, deuteration causes the specific heat to increase.
(13) The gauge phase factor $[0, \lambda w]$ makes the operators gauge invariant.
(13) The gauge phase factor $[0, \lambda w]$ causes the operators to be gauge invariant.
(14) This condensation makes ϕ_1 more ordered than ϕ_2.
(14) The condensation causes ϕ_1 to be more ordered than ϕ_2.
(15) These conditions make the ordinary gauge fields anti-Hermitian.
(15) These conditions cause the ordinary gauge fields to be anti-Hermitian.
(16) This transformation makes the metric in the following form:
(16) As a result of this transformation, the metric has the following form:
(16*) This transformation causes the metric to take the following form:
(17) It is thus seen that generation of order makes two modifications to the specific heat.
(17) It is thus seen that generation of order /causes/results in/ two modifications of the specific heat.
(18) The two coherent vortices interact, which makes them move slowly in the $+z$ direction.
(18) The two coherent vortices interact, and as a result, they move slowly in the $+z$ direction.
(18*) The interaction of the two vortices causes them to move slowly in the $+z$ direction.

These examples demonstrate that when the intended meaning can be expressed with the construction *cause + [infinitive clause]* (appearing in (12), (13), (14), (15), (16*) and (18*)), in scholarly writing, this construction is usually better than *make + [infinitive clause]*.

33.2.6 Misuse of *make* with *to + [infinitive]*

Unlike *cause*, *make* cannot be used with *to + [infinitive]*. Such erroneous grammatical constructions are fairly common. Here, I give example sentences that demonstrate this type of mistake, among others.

(19) The non-zero chemical potential μ makes the fermion determinant to be complex.
(19) The non-zero chemical potential μ leads to a complex fermion determinant.
(19*) Because the chemical potential μ is non-zero, the fermion determinant is complex.
(20) This compactification makes the 4-D cylinder to a 3-D sphere.

(20) This compactification causes the 4-D cylinder to become a 3-D sphere.
(21) The arbitrariness of these constants makes the theory to be renormalizable.
(21) The arbitrariness of these constants makes the theory renormalizable.
(22) This difference makes δ_μ not to be invariant.
(22) Because of this difference, δ_μ is not invariant.
(23) This effect makes $\vec{V}$ and $\vec{N}$ to be parallel.
(23) This effect makes $\vec{V}$ and $\vec{N}$ parallel.
(23*) This effect causes $\vec{V}$ and $\vec{N}$ to become parallel.

Note that the grammatical structure of (20) is different from that of the other examples here. This structure too is incorrect. It should also be pointed out that (21) is an exception to the general guideline I mentioned in Section 2.5. In this case, while *cause + to be + [adjective]* could be used, because the causal connection described here appears to be somewhat indirect, *make + [adjective]* actually seems better.

33.2.7 Various types of illogical use

The following examples contain assertions that are, for a variety of reasons and to varying degrees, illogical. Here I simply give corrected versions, without explanation.

(24) This choice of h makes a periodic state as an attractor of the dynamics.
(24) With this choice of h there is an attractor of the dynamics corresponding to a periodic state.
(25) Each of these contributions makes a peak in the form factor.
(25) Each of these contributions /results in/creates/ a peak in the form factor.
(26) Higher-order approximations are expected to make this difference smaller.
(26) Higher-order approximations are expected to /yield/give/result in/ a smaller difference.
(26*) Higher-order approximations are expected to lessen this difference.
(27) A comparison of these weights makes us adjust the background charge.
(27) A comparison of these weights /shows/reveals/ that it is necessary to adjust the background charge.
(28) This experimental setup makes cracks grow directionally by evaporation from one side of the system.
(28) In this experimental setup, cracks grow directionally as a result of evaporation induced on one side of the system.
(29) The smaller number of sample events makes the curves less clearly defined.
(29) The smaller number of sample events results in less clearly defined

curves.
(29*) Because there are fewer sample events, the curves are less clearly defined.
(30) We have found that the digital computation makes spurious periodic orbits.
(30) We have found that the digital nature of the computation /creates/leads to the creation of/ spurious periodic orbits.
(30*) We have found that because of the digital nature of the computation, spurious periodic orbits are created.
(30**) We have found that spurious periodic orbits appear as a result of the digital nature of the computation.
(31) The infinite number of variables generated in this case allows highly complex behavior.
(31) The existence of an infinite number of variables in this case /leads to/makes possible/results in/ highly complex behavior.
(32) This small parameter in f causes a high peak at the boundary $x = 0$.
(32) The presence of this small parameter in f /causes/induces/ the appearance of a high peak at the boundary $x = 0$.
(32*) The smallness of this parameter in f /results in/creates/ a high peak at the boundary $x = 0$.
(32**) This small parameter in f causes the peak at the boundary $x = 0$ to become high.
(32***) Because this parameter in f is small, the peak at the boundary $x = 0$ is high.

33.3 Similar words

In this section, I present some additional verbs that are similar to those considered in this chapter. The meaning of non-interference expressed by *allow* and *let* is also expressed by *make possible*, *facilitate*, *enable*, *permit* and *admit*, although *make possible*, *facilitate* and *enable* are somewhat more active in implication than the others. The meaning of compulsion expressed by *cause* and *make* is also expressed by *force*, *compel*, *constrain*, *require*, *necessitate*, *oblige* and *drive*. However, *require*, *necessitate* and *oblige* are more commonly used in regard to human activity.

Chapter 34

change

34.1 Misused in reference to functional dependence

In mathematical contexts, use of the noun *change* in reference to functional dependence should be avoided.[1] The most common misuse of this kind is illustrated by the following.

> (1) The eigenvalue of the ground state changes according to the change of ν.

While this type of expression is extremely awkward and unnecessarily vague, it is surprisingly common. This should be rewritten as follows.

> (1) The eigenvalue of the ground state /depends on/is a function of/ ν.

Below I give examples containing similar types of problems.

> (2) The properties of the α-process change accordingly with the change in T.
> (2) The properties of the α-process depend on T.
> (3) We observed a change of the coupling according to the degree of synchronization.
> (3) We observed a dependence of the coupling on the degree of synchronization.
> (4) We plot Z_μ with the change of connection strength in Fig. 2.
> (4) We plot Z_μ as a function of the connection strength in Fig. 2.
> (5) The values of p at some points change periodically in time.
> (5) The values of p at some points are periodic functions of time.
> (5*) The values of p at some points occasionally change.
> (6) The state temporally changes according to the following set of equations:
> (6) The time evolution of the state is determined by the following set of

[1] It seems that perhaps the problematic use of *change* treated in this section results from the inappropriate translation of 変動. In most cases, in reference to the behavior of some function, the meaning of 変動 is not properly expressed by *change*.

equations:
(6*) The state evolves in time according to the following set of equations:
(7) The quantity g_d changes as a function of N.
(7) The quantity g_d is a function of N.
(8) The coupling strength changes depending on the states of the units globally.
(8) The coupling strength depends on the states of the units.
(9) In this case, the temperature change in $C'(T)$ comes only from that in ϵ_∞.
(9) In this case, the temperature dependence of $C'(T)$ is due only to that of ϵ_∞.
(10) Temporal changes of p are shown in Fig. 2.
(10) The functional dependence of p on time is displayed in Fig. 2.
(10*) The temporal fluctuations of p are displayed in Fig. 2.
(10**) In Fig. 2, p is plotted as a function of time.
(11) We next examine how region I moves according to the change of the input correlation time scale τ.
(11) We next examine how region I moves as the input correlation time scale τ is changed.
(11*) We next examine how the position of region I depends on the input correlation time scale τ.
(12) We have plotted the change of the x values at the attractor with the change of x_d.
(12) We have plotted x at the attractor as a function of x_d.
(13) In this regime the membrane exhibits chaotic change.
(13) In this regime the membrane exhibits chaotic /fluctuation/behavior/dynamics/.
(14) We made dielectric measurements to determine the thickness dependence of the glass transition temperature in atactic polystyrene from the temperature change in the electric capacitance.
(14) We made dielectric measurements to determine the thickness dependence of the glass transition temperature in atactic polystyrene by finding the temperature dependence of the electric capacitance.

As seen from these examples, when *change* is misused in the manner considered here, often the intended meaning can be expressed, as a verb, by *depend on*, *are functions of*, *evolve* or *fluctuate*, or, as a noun, by *dependence*, *evolution*, *fluctuation* or *dynamics*.

34.2 Redundant use

The term *dynamic* contains the meaning of *change*, and therefore in expressions like those below, *change* is unnecessary.

(1) However, the relation between the dynamical change of ρ and the formation of ϕ-tubules is not yet clear.

(1) However, the relation between the dynamic behavior of ρ and the formation of ϕ-tubules is not yet clear.
(1*) However, the relation between the dynamics of ρ and the formation of ϕ-tubules is not yet clear.
(2) The characteristic time for the dynamical change in the dielectric strength for the α-process diverges in this limit.
(2) The characteristic time of the change in the dielectric strength for the α-process diverges in this limit.
(2*) The characteristic time for the dynamics of the dielectric strength for the α-process diverges in this limit.

34.3 Misused to describe the action of an inanimate object changing itself

Consider the following.

(1) The point changes its type according to the map $g_n(x)$.
(1) The type of the point changes in accordance with the map $g_n(x)$.
(1*) The type of the point changes as it is mapped under $g_n(x)$.
(2) We see in this figure that F changes its K dependence.
(2) We see in this figure that the nature of the K dependence of F changes.
(3) The element at position 1 changes its period from T_0 to $2T_0$.
(3) The period of the element at position 1 changes from T_0 to $2T_0$.
(4) There are two energies at which the potential changes its shape drastically.
(4) There are two energies at which the shape of the potential changes drastically.
(5) Through feedback from the smaller subsystem to the larger one, the latter may change its state.
(5) Through feedback from the smaller subsystem to the larger one, the state of the latter may change.

The original sentences here are very unnatural because they describe actions of inanimate objects changing themselves. In general, in order for assertions like those above to make sense, the thing undergoing the change must play an active role in causing this change. While there certainly are situations in which inanimate objects can be regarded as playing such a role (for example, a robot), these are quite rare.

34.4 Misused as a synonym of *vary*

Although *change* and *vary* can often be used interchangeably, there are situations in which only the latter should be used. The following illustrate some such situations.

(1) With the change of these two parameters, each of the four phases can be realized.

(1) By varying these two parameters, each of the four phases can be realized.
(2) We changed ξ in the range 0.4 to 0.7 in our simulations.
(2) We varied ξ in the range 0.4 to 0.7 in our simulations.
(2*) We used a number of values in the range 0.4 to 0.7 for ξ in our simulations.
(3) The beam current on the target was changed between 0.5 and 5 nA, depending on the scattering angle.
(3) The beam current on the target was varied between 0.5 and 5.0 nA by varying the scattering angle.
(3*) The beam current on the target took several values between 0.5 and 5.0 nA, as determined by the scattering angle.
(4) The value of y here can change continuously.
(4) The value of y here can vary continuously.
(4*) Here y is a continuous variable.

The problem with (1)–(3) is that their use of "change" seems to imply that the values of the quantities under consideration are changed only once. For example, the intimation of (3) is that the beam current was initially set at 0.5 nA, and then it was changed in one step to 5.0 nA (and then perhaps changed back and forth between 0.5 nA and 5.0 nA in single steps). The rewritten versions express the desired meanings, that these quantities are understood to take several, many or a continuous range of values. The last example is different. Here the problem is simply that the wording of the original is somewhat unnatural mathematically.

34.5 Misused in place of *different*

The following demonstrate a common type of imprecise writing.[2]

(1) The value of the cosmological parameter Ω_0 is changed in this case, compared to the case with $\sigma < \sigma_0$.
(1) The value of the cosmological parameter Ω_0 in this case differs from that in the case with $\sigma < \sigma_0$.
(2) The nature of the nucleon-nucleon interaction could be changed in the nuclear medium.
(2) The nature of the nucleon-nucleon interaction could be different in the nuclear medium.
(2*) The nature of the nucleon-nucleon interaction could be changed by the nuclear medium.
(3) The number of possible combinations in this case, 6, is changed from that in the original system.
(3) The number of possible combinations in this case, 6, is different from that in the original system.

[2]The mistaken use of *change* considered here apparently results from the inappropriate translation of 変わる. It is important to note that although 変わる can be used as a synonym of 違う, *change* can never be used to express such a meaning.

Because change is a process, when simply making a comparison of two situations, as in (1)–(3), it is inappropriate to refer to a difference between these situations as a "change." The mistaken use in these examples should be contrasted with the proper use in (2*) and the following.

> (4) The value of the cosmological parameter Ω_0 changes as σ increases beyond σ_0.

In contrast to (1), because this sentence regards not the difference between the values of Ω_0 in two different cases but, rather, the process in which this difference emerges, this use of "change" is correct.

34.6 Misuse of the noun *change* with *receive*

Use of the noun *change* with *receive* illustrated by the following sentence is poor for two reasons.

> (1) Clearly, the moment $M_n(Q^2)$ does not receive any change as a result of this replacement.
> (1) Clearly, the moment $M_n(Q^2)$ does not change as a result of this replacement.

The first problem with this type of expression is that it is usually unnecessarily verbose. The second, more serious problem is that it depicts an illogical or unnatural situation. In most contexts, change is not an entity that one thing receives from another: Something can undergo change through an external influence, but such change itself is an internal process. This is true even in a situation like the following.

> (2) The perturbation changes the form of the solution.

Here, "changes" is a verb. Now, if we were to rewrite this using the noun *change*, we would not do so with an expression that describes the change as being supplied to the solution by the perturbation (for example, *received by the solution*, *imparted to the solution*, *given to the solution*). Rather, we would have something like the following.

> (2*) The solution undergoes change as a result of the perturbation.

Chapter 35

circumstance

35.1 Misused to mean *situation*, *case* or *state*

The noun *circumstance* is often misused to mean something like *situation*, *case* or *state*. In fact, these words possess meanings on different levels, as *circumstance* (being nearly synonymous with some meanings of *condition* and *factor*) refers to something that characterizes or is attendant to a situation, state or case.[1] Consider the following examples.

> (1) This behavior is characteristic of such systems in the circumstance of a slowly varying field.
> (1) This behavior is characteristic of such systems in the case of a slowly varying field.
> (2) The quiescent circumstance becomes unstable with respect to large-scale fluctuations.
> (2) The quiescent state becomes unstable with respect to large-scale fluctuations.
> (3) The circumstance resulting from the instantaneous removal of the barrier is quite different.
> (3) The situation resulting from the instantaneous removal of the barrier is quite different.
> (4) Recent developments in technology on the nanometer scale have progressed to the point that such phenomena as single-electron tunneling and quantum nucleation are now experimentally observable. In these circumstances, tunneling problems have once again become widely studied.
> (4) ...For this reason, tunneling problems have once again become widely studied.
> (4*) ...With this situation, tunneling problems have once again become widely studied.

[1] It is important to make a distinction between singular and plural here, as the plural form *circumstances* can be used synonymously with *situation*. In English-Japanese dictionaries, 状況 is almost always listed (and 状態 is sometimes listed) under the entry for *circumstance*, but this represents a translation of *circumstances*.

(5) There is a kink at $x = x_0$, and at this point the electric charge is altered by δq. This circumstance can be interpreted as follows:
(5) ...This /situation/effect/change/ can be interpreted as follows:
(6) Here, the Cooper pair has a particular direction in three-dimensional space. This circumstance is like that with strong L–S coupling in a superconducting neutron fluid.
(6) ...This /situation/state/condition/phenomenon/ is similar to that with strong L–S coupling in a superconducting neutron fluid.
(7) This requires the gravitino mass to satisfy $m_{3/2} \lesssim 1\text{TeV}$. In these circumstances, the anomaly mediation generates SUSY-breaking masses that are too small.
(7) .../Given this condition/Under this condition/In this case/, the anomaly mediation generates SUSY-breaking masses that are too small.
(8) In our model, circumstances equivalent to a sufficient number of niches are created by the speciation mechanism.
(8) In our model, a condition equivalent to the existence of a sufficient number of niches is created by the speciation mechanism.

Note that in (7), "circumstance" is apparently used with an intended meaning of *situation*. In this case, however, "condition" (meaning 条件[2]), as in (7), is better. In (8), note that there is also the problem that "circumstances" are being compared to "a sufficient number of..." This is an illogical comparison of unlike things. This problem is solved in (8) by the insertion of "the existence of." Here, "condition" is used with a meaning quite close to that of *circumstance*, but in this case, the former is better. If *circumstance* were used here, it would seem to refer to something that is in some sense auxiliary to the model. On the other hand, "condition" here describes something more fundamental to the nature of the model as a whole. In the present case, this seems more appropriate.

35.2 Misused with the preposition *in*

In situations demonstrated by the following, *circumstance* should be used with the preposition *under* rather than *in*.

(1) The game environment may be chaotic, and the evolution of strategies in this circumstance will be very different.
(1) The game environment may be chaotic, and the evolution of strategies /under such circumstances/in such a situation/ will be very different.
(2) However, this is not the case in natural biological circumstances.
(2) However, this is not the case under natural biological /circumstances/conditions/.
(2*) However, this is not the case in natural biological situations.

Note also that the singular "circumstance" in (1) is incorrect. This demonstrates the point made in the first footnote of the previous section regarding the distinction between the singular and plural forms.

[2]Although *circumstance* is nearly synonymous with one of the meanings of *condition*, it does not possess the meaning of 条件.

35.3 Correct uses

In the previous section, I gave two examples demonstrating proper use of *circumstances*. In this section I give four more.

> (1) The circumstances under which this experiment was performed, however, were not ideal.
> (2) The appearance of such a state necessitates the simultaneous realization of many independent and extremely unlikely circumstances.
> (3) Under certain circumstances, the domain wall has metastable structures, in addition to a stable structure.
> (4) The circumstances surrounding the development of this technology were extraordinary.

Chapter 36

clue

According to my experience, the noun *clue* is greatly overused by Japanese authors. In general, it is best to avoid this word in formal writing, as there are usually better alternatives. The following illustrate typical situations in which *clue* should be strictly avoided.

36.1 Examples

36.1.1 Inappropriate expressions of the form *clue to + [noun]*

(1) With this study we hope to get a clue to the theory beyond the Standard Model.
(1) With this study, we hope to obtain information that will help in the development of a theory beyond the Standard Model.
(2) We hope that these individual results will provide clues to the proof of Theorem 3.2.
(2) We hope that these individual results will help us to construct a proof of Theorem 3.2.
(3) This provides a clue to the construction of solutions.
(3) This /should/will/ be /helpful/useful/ in the construction of solutions.
(3*) This /should/will/ provide information concerning the construction of solutions.
(4) In this way, we may get some clue to the method that can be used in such cases.
(4) In this way, we may make progress toward constructing a method that can be used in such cases.

36.1.2 Misused with *search*

(5) Moreover, this exotic behavior could be a clue for the experimental search for cold quark matter.
(5) Moreover, this exotic behavior could /be helpful/provide information valuable in/ the experimental search for cold quark matter.

(6) In this way, we were able to determine the Higgs boson mass predicted by the present model, which may be a clue to Higgs search experiments.
(6) In this way, we were able to determine the Higgs boson mass predicted by the present model. This may be /helpful/useful/ in experimental searches for this particle.

36.1.3 Misused with *question* and *problem*

(7) This may give a clue to the question, How can we see the behavior near the singular point?
(7) This may provide information about how we can see the behavior near the singular point.
(7*) This may be useful in the investigation of the behavior near the singular point.
(8) The D-string approach may provide a clue to the question, How can we see this junction point?
(8) The D-string approach may help us determine how to see this junction point.
(8*) The D-string approach may help us in the search for this junction point.
(9) This could provide a clue to the missing matter problem.
(9) This could provide a clue to solving the missing matter problem.
(9*) This could help us solve the missing matter problem.

36.1.4 Misused to mean *information*

(10) This investigation should provide some clue about the behavior of the system in the low-temperature regime.
(10) This investigation should provide some information about the behavior of the system in the low-temperature regime.
(11) This gives us some clue about the nature of these systems.
(11) This gives us some information about the nature of these systems.

36.1.5 Redundant use

(12) Forthcoming measurements will provide us with information and clues to answer these questions.
(12) Forthcoming measurements should provide us with information to help answer these questions.

36.1.6 Other misuse

(13) The main purpose of such studies will be to find a clue which can distinguish these models from 4-dimensional Einstein gravity.
(13) The main purpose of such studies is to determine how these models

differ from 4-dimensional Einstein gravity and to elucidate the implications of this difference.

(14) This effect offers an important clue in resolving the anomaly in the ${}^{5}_{\Lambda}$He binding energy.

(14) This effect offers important information for understanding the anomaly in the ${}^{5}_{\Lambda}$He binding energy.

36.2 Discussion

In most cases, *clue* is somewhat too imprecise and too informal to be used in scholarly writing. I now briefly discuss each of the above examples to address the specific problems they present.

Examples (1) and (2) represent a particularly problematic use. Usually, phrases like *clue to + [noun]* are only possible when *[noun]* represents and action.[1]

Now, consider (3) and (4). Here, again, we have expressions of the form *clue to + [noun]*, but in these sentences, *[noun]* indeed does represent an action or process. The problem here is that such expressions are only feasible when this action or process is something like solving a mystery or problem, answering a question, resolving a paradox, or, more generally, understanding something difficult. In particular, as demonstrated by (3), it cannot be used with a word like "construction," which itself does not carry any connotation of a puzzle, mystery, problem or question. Note that in the case of (3) we could state something like *...clue regarding the construction of...*, but this is somewhat indirect, and the rewritten forms appearing above are preferable.

Examples (5) and (6) also involve the use of *clue* with an action – here that of an experimental search. The type of mistaken usage demonstrated by these examples is quite common. The important point to note here is that, while the goal of an experimental search may be solving some problem, answering some question, or understanding some phenomenon, the action of performing such a search itself does not constitute anything like solving, resolving, answering, determining or understanding, and thus this usage is very unnatural. Here, we could write something like *...provide a clue to solving the problem of cold dark quark matter through an experimental search*, but this is unnecessarily verbose. Also, we could state this as *clue regarding the experimental search* or *clue to help in the experimental search*, but the forms appearing in (5) and (6) are more direct.

As stated above, usually, phrases like *clue to + [noun]* in which *[noun]* does not represent an action are not possible.[2] In (7), (8) and (9), further misuse of this kind is illustrated. In the first two of these, we could use something like *clue to answering*

[1]Note that the rewritten forms *...we hope to obtain clues to solving the mystery of a theory beyond the Standard Model* and *...we hope to obtain clues to solving the problems that may lead to a theory beyond the Standard Model* represent proper uses of "clues." However, the first of these has a somewhat dramatic and, hence, unscientific air, and the second is essentially a convoluted version of (1).

[2]There are exceptions to this rule, however. For example, *clue to the mystery* and *clue to the identity* are not terribly unnatural. However, even in these cases, *clue to solving the mystery* and *clue to determining the identity* are preferable.

the question, but the forms appearing above are better.

Clue should not be used in place of *information*. When the intended meaning can be expressed by *information*, as is clearly the case in (10) and (11), this word should be used.

Because a clue constitutes a type of information, (12) is clearly redundant. Such use of *clue* with *knowledge* should be avoided for the same reason.

Example (13) demonstrates a very imprecise style of writing. I believe the intended meaning here was something like *...clue that can be used to help distinguish...* (However, if we were to rewrite the sentence in this manner, *information* would be more appropriate than "clue.") The main problem with the original is simply that the action of distinguishing is not something that a clue can do.

The easiest way to remedy the problem in (14) would be to replace "in" with *to*. However, (14) is probably better.

Chapter 37

common

37.1 Misused to mean *same* or *equal*

37.1.1 Correct use

In one of its uses, the adjective *common* is synonymous with *shared.* This use is demonstrated by the following.

> (1) Triangles t_1 and t_2 have a common base.
> (2) The problem encountered here is common to all perturbative approaches of this kind.
> (3) The common term in these equations causes their solutions to behave similarly at large ζ.

Often, however, *common* is mistakenly used in situations that the intended meaning is similar, but slightly different from *shared.*[1] Here I present some examples.

37.1.2 Incorrect use

The misuse of *common* that I encounter most often is that in which the appropriate meaning is expressed by something like *same* or *equal.* To understand the problem here, it is instructive to first examine the three examples above to see why "common" is appropriate there.

We begin by considering (1). First, note that, in terms of both grammar and meaning, there is nothing wrong with the following sentence: *Triangles t_1 and t_2 have the same base.* However, the mathematical nuance of this sentence is different from that of (1). The intended meaning of the original is that there is some single line segment that serves as the base of both triangles. The implication of this use of "common" is that this single line segment is jointly possessed by the two triangles. If we were to use *the same* in place of "a common," this implication of joint possession would be lost. Instead, the implication would be that the two bases – one from each triangle – coincide. This example is representative of the general situation: Although *common* and *same* are similar in meaning, the former creates an image of

[1] As seen from the examples given in this chapter, there is a subtle difference in meaning between *common* and 共通.

sharing, while the latter creates an image of coincidence. For the present example, in the simplest situation, *common* is more natural. However, it should be noted that there also are situations in which *same* would be better. For example, suppose we are studying two triangles, t_1 and t_2, whose positions and/or shapes depend on some parameter. Then, suppose that in general the bases of these triangles are distinct but that at some parameter value they coincide. In this situation, it is most natural to think in terms of two coincident bases rather than one shared base, and hence in this case, *same* would be appropriate.[2]

To make this discussion more concrete, let us consider another example.

> (1′) The bases b_1 and b_2 of triangles t_1 and t_2 are common.
> (1′) The bases b_1 and b_2 of triangles t_1 and t_2 are the same.

There are several points demonstrated by (1), (1′) and (1′) that deserve mention. First, *common* describes individual things (like "base" in (1)), whereas *same* describes groups of things (like "b_1 and b_2" in (1′)). With regard to grammatical structure, these two adjectives are quite similar in that they can both modify a noun or nouns representing a single or multiple entities.[3] With regard to their function within such structure, however, they are quite different: *common* describes the condition of being shared for each noun it modifies **individually**, while *same* describes the condition of coincidence for nouns it modifies (and sometimes for nouns it does not modify[4]) **collectively**. The point of relevance with regard to (1′) is that in the case that *common* modifies more than one noun (or a plural noun), it never describes the relationship between the things represented by these nouns, and thus the fact that here it is apparently being used to describe the relationship between b_1 and b_2 makes this sentence quite unclear. Because of this misuse, it seems that the intended meaning here is either that two sides (namely, b_1 and b_2) of t_1 and t_2 are the same (which, obviously, would imply that these triangles are identical) or that b_1, the base of t_1, and b_2, the base of t_2, are shared by some other, unnamed things. In contrast to *common*, *same* can be used to describe the relationship between those things expressed by the nouns it modifies. This is the case in (1′). From this sentence, we see that the role of *same* is to equate things that, at least in name, have distinct existences. (Note that in (1′), "same" could be replaced by *coincident* or *identical* without changing the meaning.) This is quite different from the role played by *common*.

Now let us examine (2). In this case, *common* is very natural, because the topic of discussion here is some single "problem." Apparently, the existence of a single, specific matter constituting "this problem" has been established prior to the appearance of this sentence, and this matter is the focus of the present discussion. For this reason, the idea that this problem is jointly possessed by the perturbative approaches under consideration is natural. Now, compare (2) with the following.

---

[2] However, in such a situation, something like *The bases of triangles t_1 and t_2 become the same* or *The bases of triangles t_1 and t_2 come to coincide* would be more natural than the sentence given above.

[3] The following demonstrate these different possibilities: *A is common to B and C*; *A_1 and A_2 are common to B and C*; *A_1 is the same as A_2*; *A_1 and A_2 are the same.*

[4] For example, in the third example of the previous footnote, "same" does not modify "A_2."

(2′) Note that all such perturbative approaches have the same problem.

While there is nothing wrong with this sentence in itself, it could not be used in the situation considered presently, in which the "problem" in question has been previously introduced (and thus its existence as a single matter has been established). Instead, this sentence would be used to introduce such a problem, and in this case, *common* would be inappropriate. In particular, the following sentence would not be possible.

(2′) Note that all such perturbative approaches have a common problem.

The first fault with this sentence is that, because "all...have" and "common" express essentially the same meaning, it is redundant. (For the same reason, *Both of the triangles* t_1 *and* t_2 *have a common base* is incorrect.) However, if we simply deleted "all," the resulting sentence would be ambiguous. In this case, it would in fact be more natural to interpret "common" as a synonym of *frequently occurring*, rather than *shared*.

The use of "common" in (3) is easily understood, as the idea that both of these equations possess the term in question is quite natural. In this case, without putting this sentence into a completely different form, it would not be possible to express the intended meaning using *same*.

I now give some examples demonstrating additional misuses of *common* when the intended meaning is close to that of *same* or *equal*.

(4) All of these oscillators have a common average frequency.
(4) All of these oscillators have the same average frequency.
(4*) The average frequencies of all of these oscillators are equal.
(5) The transition happens unless all components in a multiplet of the symmetry group have a common Z_2 parity.
(5) The transition occurs unless all components in a multiplet of the symmetry group have the same Z_2 parity.
(5*) The transition occurs unless the Z_2 parities for all components in a multiplet of the symmetry group are equal.
(6) This generates a common SUSY-breaking mass for all squarks and sleptons.
(6) This generates SUSY-breaking masses that are equal for all squarks and sleptons.
(7) Those operators that have common canonical dimension and quantum numbers mix with each other.
(7) Those operators that have the same canonical dimension and quantum numbers mix with each other.
(8) Here we consider a different system using a common approach with Ref. [3].
(8) Here we consider a different system using the approach of Ref. [3].
(9) These games are all of a common nature.
(9) These games are all of /a single/the same/ nature.
(10) Here T is normalized commonly to the other charges.
(10) Here T is normalized in the same manner as the other charges.

The original sentences here are problematic for several reasons. First, note that, as discussed above, the use of "common" with "all...have" appearing in (4) and (5) is redundant. This is true also for "common" and "for all" in (6) and "common" and "all of" in (9). In addition, the original sentences are all – to varying degrees – strange, because the idea of sharing or joint possession expressed by "common" is unnatural. For example, let us consider (4). Here, the intended meaning is most likely that each of these oscillators has an average frequency and that in the case under investigation, the values of all such frequencies are all equal. This use of "common," however, seems to imply that we are thinking in terms of some single average frequency that is possessed by all of the oscillators jointly. The difference here, as in the situation discussed with regard to (1), is one of context. If, within the present context, it is more natural to think of the coincidence of multiple frequencies, then *same* is appropriate, whereas if it is more natural to think of the sharing of a single frequency, then *common* is appropriate. However, even in the latter case, (4) would not properly describe the situation. Instead, we would have to use something like the following.

(4**) The average frequency ϖ is common to all oscillators.

Examples (5), (6) and (7) are similar to (4). In (8), the intended meaning is clearly one of sameness rather than sharing. In the case of (9), the redundancy could be removed by simply deleting "all." However, the resulting sentence would be ambiguous, as "common" could be interpreted as meaning *frequently occurring*. As demonstrated by (10), the adverb *commonly* should never be used to mean *in the same manner*.

Allow me to end this section by reiterating its main point: In general, when the intended meaning can be expressed using *same*, *equal*, or any word describing a condition of sameness or coincidence, *common* should not be used.

In the following sections I consider several other types of misuses of *common*.

37.2 Misused to mean *general* or *generic*

Common cannot be used in place of *general* or *generic*. Here I give typical examples of such misuse.

(1) In this paper, we attempt to capture common dynamics of stem cell systems.
(1) In this paper, we attempt to capture the generic dynamics of stem cell systems.
(1*) In this paper, we attempt to capture the general dynamics common to all stem cell systems.
(1**) In this paper, we attempt to capture dynamics that often appear in stem cell systems.
(2) This concept applies commonly to the different formulations of the problem.
(2) This concept applies generally to the different formulations of the problem.

(2*) This concept applies in the same manner to the different formulations of the problem.
(3) The society has a common rule governing its units.
(3) There is a general rule governing each unit of the society.
(3*) The society is governed by a single rule common to all units.

37.3 Misused with a collective noun

Because *common* expresses the meaning of joint possession by multiple entities, it cannot be used with collective nouns as in the following.

(1) The most basic biological processes are common to the animal kingdom.
(1) The most basic biological processes are common to all members of the animal kingdom.
(1*) The most basic biological processes are /exhibited throughout/ubiquitous in/universal in/ the animal kingdom.

Because "animal kingdom" refers to a single thing, the use of "common" in (1) is illogical.

37.4 Problems with preposition use

The expression *common to* is a set, synonymous with *shared by*. There are two points that should be noted with regard to use of this adjective-preposition set. First, *to* is the only preposition that can be used with *common* in this way to express the meaning of *shared by*. Second, in general, it is preferable that no words appear between *common* and *to* when they are used together in this manner.

37.4.1 Misused with prepositions other than *to*

When *common* is used with a preposition to form a grammatical set, if this preposition is **not** *to*, the resulting meaning of *common* is that of *frequently /appearing/present/occurring/...*, not *shared*. The prepositions most often misused in place of *to* in such a situation are *among* and *for*. The following are typical.

(1) If this process is common among all members, there is no novelty.
(1) If this process is common to all members, there is no novelty.
(1*) If this process is exhibited by all members, there is no novelty.
(1**) If this process is exhibited often by all members, there is no novelty.
(2) It is well known that the behavior in the $t \to 0$ limit is common for all the cases.
(2) It is well known that the behavior in the $t \to 0$ limit is the same for all cases.

Note that (2) also has the problem discussed in the first section.

37.4.2 Splitting of adjective-preposition pair

Adjective-preposition pairs that act as units are quite common in English.[5] In most situations, it is best to avoid splitting such expressions. This is particularly true for the pair *common to*, because the resulting sentence can become ambiguous. (For discussion of other common examples of this type of problem, see Chapters 47, 93 and 113.)

> (3) A straightforward application of the Frogatt-Nielsen mechanism yields a common hierarchical mass matrix to up, down and lepton sectors.
> (3) A straightforward application of the Frogatt-Nielsen mechanism yields a single hierarchical mass matrix common to up, down and lepton sectors.
> (3*) A straightforward application of the Frogatt-Nielsen mechanism yields the same hierarchical mass matrix for up, down and lepton sectors.

If we do not consider the content of the sentence, "common" in (3) is most naturally interpreted as meaning something like *frequently occurring* or *ordinary*. However, the intended meaning actually appears to be that expressed by one of the rewritten forms.

37.5 Redundant use

In the previous sections, I briefly discussed the redundant use of *common*. Here I give some examples illustrating different types of redundant use.

> (1) Arranged in this cyclic order, successive edges of the propagators share a common D-instanton label.
> (1) Arranged in this cyclic order, successive edges of the propagators have a common D-instanton label.
> (2) This five-dimensional theory shares the common properties with the superconformal theory.
> (2) This five-dimensional theory possesses some of the properties of the superconformal theory.
> (3) This new form of the theory retains several common features with the original form.
> (3) This new form of the theory retains several features of the original form.
> (3*) This new form of the theory has several features in common with the original form.

As demonstrated by (1) and (2), the direct object of the verb *share* should never be modified by the adjective *common*. The intended meaning of (2) is somewhat unclear, but (2) seems to be the most natural interpretation. Example (3) is problematic because the assertion that these features are "retained" by the new form of the theory alone implies that they are common to the two theories in question.

[5] For example, *absent from*, *available to*, *capable of*, *characteristic of*, *dependent on*, *different from*, *involved in*, *prepared for*, *similar to*, *superior to*, *typical of*.

37.6 Other inappropriate use

The following are representative examples of some other problematic usage of *common.*

> (1) This difficulty is directly related to the common appearance of the Q in both equations.
> (1) This difficulty is directly related to the fact that Q appears in both equations.
> (1*) This difficulty is directly related to the fact that Q plays the same role in both equations.
> (2) Throughout the simulations, the parameter T was commonly set to $T = 400$.
> (2) The parameter T was set to 400 in all simulations.
> (3) The general form of the q^2 distribution is common to several other distributions.
> (3) The general form of the q^2 distribution is exhibited by several other distributions.
> (3*) Several other distributions have the same general form as the q^2 distribution.

In each case here, "common" is being used to express a meaning that is in some sense close to that of *shared*, but in each case this meaning is not quite correct. For example, (1) has the rather strange implication that this "appearance" is shared. The intended meaning of this sentence seems to be that expressed by (1), but (1*) is also possible. In (2), "commonly" modifies "set," and thus the connotation is that it is the "setting" of the parameter value (rather than the value itself) that is common. The problem with (3) is simply that the phrase "common to several" is unnatural; usually, *common* is used in this way only with *all.* (Note that *common to many*, *common to most*, *common to some*, etc., are also somewhat unusual.)

Chapter 38

compared

38.1 Misuse of *compared /to/with/*

38.1.1 Introduction

The passive form of the verb *compare* can be used to introduce a clause that qualifies an adjective or adverb describing extent, degree or quantity, as in the following.[1]

> (1) Fractures in gels propagate very slowly compared with those in solid materials.
> (2) In this case, the size of the Wilson loop is large compared with the typical size of the instanton.

In (1), the participle clause "compared with...materials" grammatically modifies the noun "fractures" and semantically qualifies the adverb "slowly." This expression provides the context or standard with respect to which the meaning of this adverb is established. In (2), the participle clause "compared with...instanton" modifies the noun "size" and qualifies the adjective "large," again providing a kind of standard. As these sentences demonstrate, when using the expression *compared /with/to/*, the noun modified by *compared* and the object of the preposition *with* or *to* represent the things being compared. There are two important points to note about this usage.[2] First, an adjective or adverb qualified by an expression of the form *compared /with/to/...*[3] should not possess a comparative meaning. The reason for this is that because the phrase *compared /with/to/...* provides the context or standard with respect to which the statement is being made, the idea of comparison is already expressed. Thus, in the above sentences we have "very slowly" and "large," not *much more slowly* and *larger*. These modifying adverbs express an absolute meaning within the context established by the participle clauses "compared with..." Second, phrases of this kind are only used to qualify adverbs and adjectives, never verbs.

[1]This passive verb form is called a 'passive participle' or 'past participle'. In the situation considered presently, it introduces what is called a 'participle clause.' In terms of grammar, such a clause acts as an adjective, modifying a noun, but in terms of meaning, it qualifies an adjective or adverb, and in this sense is similar to an adverbial clause.

[2]In this usage, *compared /with/to/* is identical in meaning to *in comparison /with/to/*.

[3]In general, *compared with* is best used in describing differences, and *compared to* is best used in describing similarities.

Below I present some examples illustrating the misuse of *compared* with regard to these two points.

38.1.2 Misuse with comparative adverbs and adjectives

The following illustrate the most common erroneous use of *compared /with/to/...*.[4]

(3) The conserved case is not as well understood compared with the non-conserved case.
(3) The conserved case is not as well understood as the non-conserved case.
(4) This is smaller by 10% compared to $\mathcal{F}$.
(4) This is smaller than $\mathcal{F}$ by 10%.
(5) This is a great improvement on the calculation cost compared with our previous method.
(5) This is a great improvement over our previous method with regard to calculation cost.
(5*) This reduced calculational cost represents a great improvement over our previous model.
(5**) In terms of calculational cost, this is a great improvement over our previous model.
(6) In this case, we can ignore states of considerably higher energy compared with the first excited state.
(6) In this case, we can ignore states that are considerably higher in energy than the first excited state.
(6*) In this case, we can ignore states /at/with/ energies much higher than that of the first excited state.
(7) Thus $\delta q(x, \mu^2)$ should possess different information regarding the nucleon spin structure compared with $\Delta q(x, \mu^2)$.
(7) Thus $\delta q(x, \mu^2)$ should possess different information regarding nucleon spin structure than $\Delta q(x, \mu^2)$.
(7*) Thus $\delta q(x, \mu^2)$ and $\Delta q(x, \mu^2)$ should possess different information regarding the nucleon spin structure.
(8) It is thus seen that the evolution of $\tilde{\sigma}$ has rather different behavior in the small x region compared with that of σ.
(8) It is thus seen that the evolution of $\tilde{\sigma}$ in the small x region differs significantly from that of σ.
(9) However, our model exhibits very different dynamics compared with the Hopfield net.
(9) However, our model exhibits dynamics that differ greatly from those of the Hopfield net.
(9*) However, our model and the Hopfield net exhibit very different dynamics.
(9**) However, the dynamics of our model differ greatly from those of

[4] The misuse considered here seems to result from the direct translation of such expressions as *A* は *B* に比べて、より小さい領域だ. Note that in English, this would not become *Compared to B, A is a smaller domain* but, rather, simply *A is a smaller domain than B*.

the Hopfield net.
(10) The frequency is much more sensitive to this change compared to the amplitude.
(10) The frequency is much more sensitive to this change than the amplitude.

38.1.3 Misused to modify or qualify verbs

I often find *compared* used to modify or qualify verbs that express some kind of change. This usage is simply incorrect.

(10) For this reason, deuteration of the system makes the specific heat increase compared to the undeuterated system.
(10) For this reason, deuteration of the system causes the specific heat to increase.
(11) In this regime, the glass transition temperature decreases with decreasing film thickness compared with the bulk value.
(11) In this regime, the glass transition temperature becomes smaller than the bulk value as the thickness decreases.
(11*) In this regime, the glass transition temperature decreases as the thickness becomes smaller than the bulk value.
(11**) In this regime, the glass transition temperature is an increasing function of the film thickness.
(12) Compared with the one-loop analysis for the Higgs boson mass, two loop effects lower the values by approximately 6 GeV.
(12) The two-loop analysis for the Higgs boson mass gives a value approximately 6 GeV smaller than that given by the one-loop analysis.
(13) The higher-order twist contributions are suppressed by successively increasing powers of $1/N$ compared to the leading-order contribution.
(13) The higher-order twist contributions are smaller than the leading-order contribution by factors of successively increasing powers of $1/N$.
(13*) The higher-order twist contributions are of successively increasing order in $1/N$.
(14) The ground state correlations induced by the spin-isospin interaction reduce $|M|$ compared with the independent quasiparticle case.
(14) The ground state correlations induced by the spin-isospin interaction cause $|M|$ to become smaller than in the independent quasiparticle case.
(15) It is observed that the threshold density is remarkably lowered as compared with the zero temperature case.
(15) It is observed that the threshold density is much smaller than in the zero temperature case.

The verbs that “compared with” or “compared to” is being used to modify or qualify here are the following: “increase,” “decrease,” “lower,” “are suppressed,” “reduce” and “is...lowered.” Among these examples, two warrant special attention. First,

note that in (10), the information provided by the phrase "to the undeuterated system" is completely unnecessary. Second, of the original sentences here, (11) is particularly unclear. The rewritten versions given above simply represent the most likely possibilities for the meaning intended by the author.

38.1.4 Misused when there is no comparison

Sometimes I find *compared* used when in fact no comparison is being made. The following is typical.

> (16) Compared with the previous case, in the present case there exist some ambiguities in the determination of the cross section due to the inhomogeneity of the target foil.
> (16) /Compared/In comparison/ with the previous case, in the present case there exist many ambiguities in the determination of the cross section due to the inhomogeneity of the target foil.
> (16*) In contrast to the previous case, in the present case there exist some ambiguities in the determination of the cross section due to the inhomogeneity of the target foil.

Note that in the original here, the clause "compared...case" is being used to qualify the meaning of the main statement, "in the present case, there exist some ambiguities...," by comparing the presently considered case with some other case. However, the meaning of this statement cannot be determined through comparison to some other case, because, in general, *some* (unlike, for example, *slow*, *large*, *many*...) does not represent a quality that can be compared. The intended meaning here seems to be either that there are more ambiguities in this case than in the previous case (expressed by (16)) or that there exist ambiguities in the present case but not in the previous case (expressed by (16*)).

38.2 Awkward use of *as compared /with/to/*

The phrase *as compared /with/to/* can be used in the manner demonstrated below.

> (1) The strength of the interaction increases very rapidly in the present case, as compared with the case investigated above.
> (2) There are several practical advantages of this simplified method, as compared with the more mathematically rigorous method.

As can be seen from these examples, *as compared /with/to/* is essentially equivalent to *when compared /with/to/*. These phrases are used to express a comparison drawn between different contexts that regards some object of comparison characterizing these contexts. In (1), the two "cases" are being compared, and their comparison is made with respect to the increase of the "strength of the interaction." In (2), the two "methods" are being compared, and their comparison is made in regard to "advantages." As the above sentences demonstrate, when using *as compared /with/to/*, just as in the case of *compared /with/to/*, the two things being compared are those

expressed by the object of the preposition *with* or *to* and the noun modified by the participle *compared*. It is important to note, however, that despite this similarity, the role of *as compared /with/to/* differs from that of *compared /with/to/*. While *as compared /with/to/* is used to compare different cases in terms of some characterizing factor (some quantity, quality, phenomenon, entity, etc.), *compared /with/to/* is used to compare such factors themselves.[5] It should be emphasized that we cannot simply replace "as compared with" by *compared with* in these sentences, although the latter could be used in a sentence similar to (1), as seen below.[6]

> (1′) The strength of the interaction in the present case increases very rapidly compared with that in the case investigated above.

In this sentence, in contrast to (1), the two "strengths" are being compared.

I often find *as compared /with/to/* used awkwardly. The following are typical examples.

> (1) We see from the figure that the ability to recall a pattern is enhanced as compared with the auto-associative model.
> (1) We see from the figure that the ability to recall a pattern is greater here than in the auto-associative model.
> (1*) We see from the figure that the ability of the present model to recall a pattern is enhanced in comparison with the auto-associative model.
> (2) The storage capacity in case I is about 0.28 as compared to 0.14 in case II.
> (2) The storage capacity is approximately 0.28 in case I and 0.14 in case II.
> (2*) The storage capacity is approximately 0.28 in case I, which is significantly larger than the value in case II, 0.14.
> (2**) The storage capacity is quite large in case I, as compared with case II (0.28 versus 0.14).
> (3) We now describe one distinct property of our phase diagram as compared with the case of phase locking.
> (3) We now describe one property of our phase diagram that is not seen in the case of phase locking.
> (4) As compared with two-dimensional fracture, the third dimension allows many new phenomena.

[5] This difference in meaning reflects a difference in grammatical roles. While *compared /to/with* is used to introduce a participle clause, which as a whole acts as an adjective, *as compared /to/with/* (in which "as" is a conjunction) is used to introduce an adverbial clause, which as a whole acts as an adverb (although "compared" itself acts as an adjective). The participle clause introduced by *compared /to/with/* modifies the noun representing one of the things that is being compared. (In (1) and (2) of the previous section, these nouns are "fractures" and "size.") Contrastingly, the adverbial clause introduced by *as compared /to/with/* modifies the adjective or adverb that describes the object with respect to which the comparison is carried out. (In (1) and (2) of this section, the words modified are the adverb "rapidly" and the adjective "practical." These describe the increase of the "strength of the interaction" and the "advantages.")

[6] Contrastingly, there is no way to naturally express the meaning of (2) using *compared with* in place of *as compared with*.

(4) There are many types of phenomena displayed by fractures in three dimensions that do not exist in two dimensions.

Example (1) is quite unnatural, because it seems that "auto-associative model" is being compared with "ability." The problem here is that this model is meant to be compared with some other model, but this other model is not named. The use of "as compared to" in (2) is unnecessary, because the comparison being made in this case requires no specification of scope or situation. Example (2^{**}) demonstrates how something like the original could be expressed using *as compared with*,[7] but (2^{*}) is better. Like (1), (3) and (4) are illogical, as they compare unlike things.

[7] Note that *with* is more appropriate than *to* here.

Chapter 39

concerned and *concerning*

39.1 Proper use

39.1.1 Used in regard to human interest

The main meanings of the adjectives *concerned* and *concerning* relate to human emotion or matters of human involvement or interest. Such meanings are demonstrated by the following.

> (1) Information was sent immediately to individuals concerned.
> (1′) Information was sent immediately to concerned individuals.
> (2) There are more concerning matters at this time.
> (3) She had a concerned look on her face.

The meaning of "individuals concerned" in (1) is *individuals who are involved* (with a connotation of *interest*), the meaning of "concerned individuals" in (1′) is *individuals who are interested* (with a connotation of *involvement*), the meaning of "concerning matters" in (2) is *matters that cause worry*, and the meaning of "concerned look" in (3) is *a look that conveys worry/apprehension.*

39.1.2 Used to mean *regarding*, *in relation to* or *involved*

The verb *concern* can be used in the following manner to mean something like *be about*, *regard* or *relate to*: *This article concerns the effects of deforestation.* The participle forms of this word, *concerned* and *concerning*,[1] can be used in a similar sense, as demonstrated below.

> (4) He wrote two papers concerned with the stability of biomes.
> (5) The details of chemical processes concerned in human thought are still largely unknown.
> (6) Here we consider only terms concerning ensemble averages.
> (7) Works concerning this class of phenomena began appearing about thirty years ago.

[1]Verb forms that can act as adjectives are called 'participles'. *Concerned* is a past (or passive) participle, and *concerning* is a present (or active) participle.

(8) As far as the presently considered behavior is concerned, this complication is irrelevant.
(9) These elements are concerned in both interactions.
(10) This book is concerned with only the first of these problems.

39.2 Misuse

Apparently there exists a very common misconception among Japanese that the participles *concerned* and *concerning* can be used synonymously with such expressions as *in question*, *of interest* and *under consideration*. In fact, they possess no such meanings.[2]

(1) We give a different form for the 't Hooft tensor concerned here.
(1) We give a different form for the 't Hooft tensor /in question/of interest/under consideration/that we consider/that concerns us/under study/under investigation/ here.
(2) Thus the memory concerned is output after several linking stages.
(2) Thus the memory /with which we are concerned/in question/of interest/ is output after several linking stages.
(3) If a Milnor attractor remains, the asymptotic behavior of the concerned system is not transitory.
(3) If a Milnor attractor remains, the asymptotic behavior of the system /of interest/under study/under investigation/that we study/ is not transitory.
(4) In cortices, the concerning system consists of on the order of 10^5 interacting neurons.
(4) In cortices, the system /in question/of interest/we consider/under consideration/ consists of on the order of 10^5 interacting neurons.
(5) The concerned topic has been studied for many years.
(5) The topic /of interest/under investigation/in question/ has been studied for many years.
(5*) The topic with which we are concerned has been studied for many years.
(6) The concerning effects of this class of perturbations to the asymptotic behavior are discussed below.
(6) The effects of this class of perturbations relevant to the asymptotic behavior are discussed below.
(7) Hence we do not have to consider this effect for the isoscalar exchange channel concerned.
(7) Hence we do not have to consider this effect for the isoscalar exchange channel /with which we are concerned/under study/in question/of interest/.

[2]The misuse here seems to result from the mistaken translation of 関係している as *concerned* or *concerning*. Although this translation is appropriate in the situations illustrated by some of the examples given in the previous section, it is never appropriate when the intended meaning is close to that of 当の, 問題の or くだんの.

39.3 *concerned with/in* vs. *concerned about*

As discussed in Section 1, the *[adjective] + [preposition]* combinations *concerned with* and *concerned in* can be used with meanings similar to those of *with regard to* and *involved in*, as demonstrated by (4), (5), (9) and (10) there and the examples below.

> (1) This work, however, is more concerned with formulating the proper questions than with deriving specific results.
> (2) This procedure is concerned with asymptotic behavior only.
> (3) Only elements located at the boundaries are concerned in such behavior.

In (1), "concerned with" is similar to *about* and *with regard to*, in (2) "is concerned with" is similar to *regards*, *is relevant to* and *addresses*, and in (3), "concerned in" is similar to *involved in* and *relevant to.* The important point to note here is that among combinations of the form *concerned + [preposition]*, only *concerned with* and *concerned in* can be used to express these types of meaning. All other expressions of this form have meanings of personal interest and, in particular, worry. The preposition most commonly misused in place of *with* or *in* in such expressions is *about.* The following is typical.

> (4) We are concerned about the quasiparticle mode with momentum **p**.
> (4) We are /interested in/concerned with/ the quasiparticle mode with momentum **p**.

Because the expression *concerned about* is synonymous with *worried about*, (4) is very strange.

Chapter 40

consideration

40.1 Correct use

The noun *consideration* has a number of meanings, but in scientific writing, it is usually used in one of four general ways: roughly synonymously with *thinking about* or *looking at*, with *discussion*, *survey* or *account*, with *taking into account*, and with *a fact or factor to be considered*. These uses are demonstrated by the following.

thinking about or *looking at*

(1) Consideration of the asymptotic behavior of this system is made in Sec. 3.
(2) Careful consideration of the points raised by Smith is necessary to properly compare his method.
(3) In this treatment, we do not take into consideration asymmetry effects.

discussion, *survey* or *account*

(4) These points are treated separately in the following consideration.
(5) Their review begins with a brief consideration of historical development.

taking into account

(6) In this case, consideration of the curvature is not necessary.
(7) This model implicitly includes consideration of the most important physical effects.

a fact or factor to be considered

(8) In developing our numerical code, computational efficiency was the main consideration.
(9) Several considerations led us to seriously rethink our original conclusions.

40.2 Incorrect use

The first of the meanings listed above is somewhat similar to those of a number of other words commonly used in scientific writing, in particular, *study*, *analysis* and *treatment*. The difference in meaning, however, is important. When used in this manner, *consideration* is somewhat vague, and in fact simply refers to the action of thinking about or mentally viewing something. This is quite different from the meanings of *study*, *analysis* and *treatment*, which imply something much more systematic and involved. Because of this important difference, *consideration* should never be used in place of these or other words that connote something more than simply pondering.

Below I give a number of illustrative examples demonstrating the misuse of *consideration*.[1]

(1) It is necessary to accumulate more theoretical considerations from various points of view.
(1) It is necessary to make additional theoretical studies from various points of view.
(1*) It is necessary to gather additional theoretical results from various points of view.
(2) Consideration of the regular interior metric might be interesting.
(2) /Study/Investigation/ of the regular interior metric might be interesting.
(2*) /Study/Investigation/ of the regular interior metric might produce interesting results.
(3) A preliminary consideration on this subject is given in Ref. [11].
(3) A preliminary study of this subject is given in Ref. [11].
(4) We believe that this will allow for consideration about such quantum gravitational states.
(4) We believe that this will allow for the investigation of such quantum gravitational states.
(5) Repeating consideration similar to that above, we first define the i-th unstable direction as follows:
(5) Repeating analysis similar to that above, we first define the i-th unstable direction as follows:
(6) At present, there is no consideration comparable to the analysis given here.
(6) At present, there is no theoretical work with which the analysis given here can be compared.
(7) Detailed considerations on this problem are given in Appendix A.
(7) A detailed treatment of this problem is given in Appendix A.
(8) Next, we extend our considerations to include the high-frequency part.

[1] Some of the mistaken uses of *consideration* treated here apparently arise from the inappropriate translation of such terms as 考察, 検討 and 吟味. It should be noted that in most situations, *consideration* is not the most suitable translation of these terms.

(8) Next, we extend our /analysis/treatment/study/ to include the high-frequency part.
(9) As a simple consideration, we carry out a variational calculation with deformed states in Sec. 1.
(9) As a simple treatment, we carry out a variational calculation with deformed states in Sec. 1.
(10) First, we review the consideration carried out in Ref. [5].
(10) First, we review the /treatment/analysis/ given in Ref. [5].
(10*) First, we review the investigation made in Ref. [5].
(11) The appearance of some kind of nonlocality in this consideration is of particular interest.
(11) The appearance of some kind of nonlocality in this /formalism/analysis/method/approach/ is of particular interest.
(12) Unoccupied levels are used in the consideration of the pairing excitation mechanism.
(12) Unoccupied levels are used in the /treatment/analysis/investigation/ of the pairing excitation mechanism.
(13) As the starting point of the consideration of this non-equilibrium system, we feel that it is more natural to express the deviation from the equilibrium state in terms of the quantities ξ_i.
(13) As the starting point for the investigation of this non-equilibrium system,...
(14) In this consideration, to avoid this unimportant singularity, we treat the microcanonical measure as a uniform measure.
(14) In this /study/computation/derivation/, to avoid this unimportant singularity, we treat the microcanonical measure as a uniform measure.

Chapter 41

contrast

There are several common types of mistakes involving the noun *contrast*. The most important point to keep in mind when using this word is that it can only be used with regard to like things. Often, usually because of sloppy writing style, I find *contrast* used to compare things that are of entirely different natures. Such use is illogical.[1] Here I consider the most serious such problems.[2]

41.1 Misplacement

Often the misuse of *contrast* is simply a matter of its misplacement within the sentence. The following examples demonstrate how its misplacement can result in confusing or even illogical expressions.

> (1) Moreover, with this method we need not introduce the channel radius explicitly to calculate the S-matrix, in contrast to standard scattering theory.
> (1) Moreover, with this method, in contrast to the method of standard scattering theory, we need not introduce the channel radius explicitly to calculate the S-matrix.
> (1*) Moreover, with this method we need not introduce the channel radius explicitly to calculate the S-matrix, in contrast to the situation in standard scattering theory.
> (2) In this type of game, the control parameter is determined by the decision maker, who is within the system, in contrast with the 'external' bifurcation parameter in dynamical systems.
> (2) In this type of game, the control parameter is determined by the decision maker, who is within the system. This contrasts with the situation in dynamical systems, in which the bifurcation parameter is fixed

[1] The discussion given here with regard to illogical usage of *in contrast to/with* obviously applies to any expression used to compare or contrast things. However, the illogical juxtaposition of fundamentally unlike things is particularly common with *in contrast to/with*.

[2] One reason that the use of *contrast* tends to cause problems for Japanese authors seems to be that, with regard to logic, there are much stricter conditions on the structure of expressions involving *in contrast to...* than on such Japanese expressions as ... と対照的に... and ... と違って....

externally.
(2*) The control parameter in this type of game, in contrast to the externally fixed bifurcation parameters in dynamical systems, is determined by the decision maker, who is within the system.

In its most basic use, the phrase *in contrast to* expresses a contrast between the two nouns that appear directly before and directly after it. More generally, we have the construction *A in contrast to B*,[3] in which A and B are expressions that act grammatically as nouns (i.e., nouns, noun phrases or noun clauses).[4] The most common problem involved with the use of *contrast* is that in which the two things being contrasted are of different types. This is the case in both (1) and (2). Let us first examine (1). Here it is clear that B corresponds to "standard scattering theory." Then, without considering the meaning of the sentence, the simplest interpretation is that the role of A is played by "S-matrix." Judging from the resulting meaning, however, it is clear that this cannot be correct. Then, assuming that this sentence is grammatically correct, the only possibility seems to be that A is "(the situation that) with this method we need not introduce the channel radius explicitly to calculate the S-matrix." With this interpretation, this sentence clearly expresses a contrast between two unlike things, and therefore represents a misuse of "contrast." The intention here was to contrast "this method" with "standard scattering theory," but this meaning is not correctly expressed by the original sentence. (In fact, this contrast too is somewhat problematic, as a "method" and a "theory" are in general different types of things.) This type of mistake, in which one of the nouns being contrasted is separated from *in contrast to*, is quite common. The corrected forms (1) and (1*) represent two ways of resolving this problem. In (1), "in contrast" correctly expresses the idea that the contrast is being made between two "methods," while in (1*), the contrast is between two situations, that with regard to the present theory and that with regard to the standard scattering theory.

The problem with (2) is similar. Here, the author intended to contrast these two types of parameters, but the original does not accomplish this. It may seem that the simplest way to correct the original is as follows: *In this type of game, the control parameter, in contrast with the externally fixed bifurcation parameter in dynamical systems, is determined by the decision maker, who is within the system.* There is a problem with this sentence, however. Note that here, "in this type of game" applies to the entire clause that follows, not simply to "control parameter." As a result, this sentence makes a contrast between "the control parameter" and "the externally fixed bifurcation parameter," and this is done within the context of "this type of game." However, this is illogical, because the externally fixed parameter does not exist in this context. The intended meaning here is to contrast the two different parameters existing within the two different contexts: that of the presently studied

[3]Note that we can also have the inverted form *in contrast to B, A*.

[4]While this is the most common construction involving *in contrast to*, there are others. For example, there is the more complicated type of construction in which A does not function as a noun but rather an independent clause describing some *situation*. In such a case, the noun in B (i.e. the object of the preposition "to") must be something like *situation*, *condition* or *case*, which clearly expresses that the situation described by A is that which is being contrasted. (An example of this is given by (1*).)

game and that of dynamical systems. Such a meaning is expressed by (2*). The other option is to contrast the two situations under consideration. This is done in (2).

41.2 Inappropriate contrast

The problem involved with each of the examples in the previous section is essentially one of misplacement. The examples below are more serious and, unlike the above, cannot be solved by simply rearranging the sentences. In all of these examples, there is some confusion about what is actually being contrasted.

(1) The reproduction of differentiated types of cells is much faster, since their maturation requires only specific nutrients, in contrast with the more general behavior of stem cells.
(1) The reproduction of differentiated types of cells is much faster, because their maturation requires only specific nutrients, in contrast to the case of stem cells, which have more general nutritional requirements.
(2) This diversity in the network is a consequence of the special nature of our model, where, in contrast with typical artificial intelligence studies, rules and objects are not separated in the beginning.
(2) This diversity in the network is a consequence of the special nature of our model, where, in contrast with typical models used in the study of artificial intelligence, rules and objects are not separated in the beginning.
(3) Although the calculational algorithm used to obtain this result is standard in Lie group theory, the calculations are often quite tedious. In contrast, it can be obtained without employing any Lie symmetries in our approach.
(3) Although the calculational algorithm used to obtain this result is standard in Lie group theory, the calculations are often quite tedious. Because our approach does not rely on Lie symmetries, the calculations it employs are, by contrast, quite simple.
(4) In contrast to the CTP formalism, the TFD counterparts of ϕ_1 and ϕ_2 are independent fields here.
(4) In the present formalism, in contrast to the CTP formalism, the TFD counterparts of ϕ_1 and ϕ_2 are independent.
(5) For closed non-periodic orbits, the semi-axes a_1 and a_2 are functions of the initial point (x, y), in contrast to the stability problem for periodic orbits.
(5) In the stability problem for closed non-periodic orbits, in contrast to that for periodic orbits, the semi-axes a_1 and a_2 are functions of the initial point (x, y).
(5*) The semi-axes a_1 and a_2 for closed non-periodic orbits, in contrast to those for periodic orbits, are functions of the initial point (x, y).
(6) In the present approach we have three pairs of canonical variables, in contrast with one pair in the light-cone temporal gauge formulation.

(6) In the present formulation we have three pairs of canonical variables. This contrasts with the situation in the light-cone temporal gauge formulation, in which there is one pair.

Each of the original examples here is problematic because either the two things being contrasted are not clearly expressed or they are of different types. These problems are corrected in the rewritten forms, which contrast the following things: in (1), two "cases"; in (2) "our model" and "typical models"; in (3) two types of "calculations"; in (4) two "formalisms"; in (5) two "stability problems"; in (5*) "semi-axes" in two cases; in (6) two "situations."

Chapter 42

deal with

42.1 Improper use

The expression *deal with* should be avoided in situations exemplified by the following sentences, in which such terms as *analyze*, *consider*, *study*, *investigate* and *discuss* are more appropriate.[1]

(1) We deal with the situation in which the intersection of these sets is empty.
(1) We /consider/treat/study/investigate/ the situation in which the intersection of these sets is empty.
(2) This system is dealt with as a special case of that considered by Rose.
(2) This system is treated as a special case of that considered by Rose.
(3) When we attempt to deal with such a model, it takes a lot of computational time.
(3) A great amount of computational time is required to /treat/analyze/ such a model.
(4) In this section, we deal with the case of small p.
(4) In this section, we /consider/study/investigate/discuss/ the case of small p.
(5) In the next section we deal with the functional integral approach to tunneling problems.
(5) In the next section we /discuss/consider/apply/ the functional integral approach to tunneling problems.
(6) In this paper, we deal with parameterized, strongly nonlinear boundary value problems.
(6) In this paper, we /consider/treat/study/analyze/investigate/ parameterized, strongly nonlinear boundary value problems.
(7) Since there is no stationary state in this case, we have to deal with an explicitly time-dependent Schrödinger equation.
(7) Because there is no stationary state in this case, we must /treat/consider/

[1]It seems that most of the misuses of *deal with* that I encounter occur when the intended meaning is that expressed by 扱う. It should be noted that in most situations, 扱う does not correspond to *deal with*.

employ/ an explicitly time-dependent Schrödinger equation.
(8) However, the previous works deal with only restricted cosmological models.
(8) However, the previous works /treat/analyze/consider/employ/involve/ investigate/ only restricted cosmological models.

42.2 Proper use

In scholarly writing, *deal with* has two typical types of usage.[2] In the first of these, it has a meaning similar to *take action with respect to* or *contend with* and carries with it an implication of attempting to overcome a problem or obstacle or properly dispose of some difficulty or undesirable situation. In each of the examples in the previous section, this is the type of meaning with which it would be interpreted. However, in each case there, this meaning is inappropriate because the noun acting as the object of "deal with"[3] does not, in itself, constitute a problem. In this first usage, *deal with* is most natural in the situation that its object represents some kind of obstacle or impediment to progress toward some goal. In scientific contexts, this is usually some difficulty encountered in research. In its second typical usage, *deal with* is employed in expressions stating the broad scope of a paper or book. These proper uses are demonstrated by the following.

(1) A saturation term is introduced to deal with the difficulty encountered in the numerical computation.
(2) It was shown in Section 2 how to deal with the complication encountered in the case of the complete set of such functions.
(3) This is fundamentally a method to deal with the divergence problem that arises from the singular nature of quantum fields.
(4) This book deals with the fundamentals of rings, groups and fields.

[2]This expression can also be used with the meaning *to carry out transactions or engage in social intercourse with (a person)*.

[3]Grammatically, there are two possible interpretations of this noun. First, we can think of *deal with* as a *[verb] + [preposition]* pair. In this case, the noun in question is the object of the prepositional phrase introduced by *with*. Second, we can think of *deal with* as itself forming a verb. In this case, the noun in question is the direct object of this verb. In some cases, the latter interpretation is more natural. For example, consider (2). This is a passive sentence, and the direct object of the **verb** *deal with* in the corresponding active sentence, "system," correctly acts as the subject of the passive form. In this case, we could not interpret "dealt with" as a *[verb] + [preposition]* pair, because there is no object of the preposition.

Chapter 43

degenerate

43.1 Introduction

The common misuse of the adjective *degenerate* reflects a widespread misunderstanding of its mathematical meaning. The most important point to keep in mind here is that *degenerate* is **not** synonymous with *equal*, *identical*, *coincident*, or any similar word. In the papers that I proofread, *degenerate* is misused to mean something like one of these at least as often as it is used correctly.[1]

43.2 Correct use

In mathematics, the term *degenerate* is used in several contexts with a number of different meanings.[2] Probably the most familiar use of this word is that in the context of eigenvalue problems: A *degenerate eigenvalue* is an eigenvalue whose multiplicity is greater than or equal to 2. In simpler terms, it is an eigenvalue to which there corresponds two or more eigenfunctions or eigenvectors. In physics (and in particular quantum mechanics), it is customary also to use *degenerate* in reference to eigenfunctions or eigenvectors characterized by a single eigenvalue and to a system possessing such eigenfunctions or eigenvectors.

With regard to oscillatory systems, *degenerate* has a somewhat more general

[1] In physics, *degenerate* possesses a second meaning, in addition to the mathematical meaning considered here. With this meaning, it describes a state of matter characterized by great density in which atoms are stripped of electrons. I do not discuss this usage here.

[2] A *degenerate critical point* of a function on a topological space is a point at which the Hessian of this function is non-invertible. In the theory of integral equations, a *degenerate kernel* is a kernel that takes a form of a particular simple (separable) type. A mapping of a domain D in $\Re^n$ into $\Re^m$ is said to be a *degenerate mapping* that is *degenerate on* a set $S \subset D$ if its Jacobian is 0 at each point in S. A *degenerate operator* is a linear operator T from a Banach space X to a Banach Y whose range is finite dimensional. *Degenerate quadratic surfaces* form a class of surfaces in Euclidean space (including parabolic cylinders, elliptic cylinders and hyperbolic cylinders). In the theory of ordinary differential equations, a *degenerate saddle point* is a saddle point of the flow corresponding to an ODE through which the number of orbits passing is smaller than the dimension of the flow. In the theory of Lie groups, a *degenerate series* is one type of series of irreducible representations of a Lie group. In the theory of complexes, a *degenerate simplex* is a simplex that is the image of a simplex under some degeneracy operator.

meaning. Here, it applies to a system with multiple modes of oscillation of which two or more possess commensurate frequencies (i.e. frequencies whose ratio is a rational number). It also applies to such modes themselves and to the motion displayed by a system of this type. A system characterized by n commensurate relationships is termed *n-fold degenerate*, and a system whose modes are all commensurate (i.e. a simply periodic system) is referred to as *completely degenerate*.

The following illustrate correct uses of *degenerate* and *degeneracy*.

> (1) In this case, the lowest eigenvalue, ω_0, is degenerate, and the two states characterized by this value, u^+ and u^-, are related as $Pu^+ = -u^-$.
> (2) When the external field is applied, the energies of the originally degenerate states are split. The lifting of this degeneracy reflects the breaking of the symmetry mentioned above.
> (3) Above the first excited state, there are two negative parity states ($S = 1/2$ and $3/2$) degenerate in energy.
> (4) When $\alpha = 0$, this is a degenerate system, as the frequencies of the two states no longer depend on their symmetries.
> (5) Because this is a nondegenerate system, the path of the system point fills the phase space.
> (6) Taking advantage of the n-fold degeneracy, we can reduce this system to one of $N - n$ frequencies through a point transformation of the action-angle variables.

43.3 Incorrect use

43.3.1 Misused to mean *equal*

Perhaps the most common error involving *degenerate* is its use as a synonym of *equal*. Such use is never possible. In fact, *degenerate* plays an entirely different role than *equal*, as it expresses not the relationship between two values but, rather, a characteristic property of a single value. Consider the following examples.

> (1) The energies of these eigenstates are degenerate.
> (1) These energy eigenstates are degenerate.
> (1*) The energies of these eigenstates are equal.
> (2) The masses m_1 and m_2 depend on the parameter α in a complicated manner and are degenerate at several values.
> (2) The masses m_1 and m_2 depend on the parameter α in a complicated manner and are equal at several values.
> (3) If we ignore this effect, the energies given by these two theories are degenerate.
> (3) If we ignore this effect, the energies given by these two theories are equal.
> (4) The eigenvalues $\alpha_{N_0}^{2n}$ and $\beta_{N_0}^{2n}$ are degenerate at $k = 0$, but they split for $k > 0$.
> (4) The eigenvalues $\alpha_{N_0}^{2n}$ and $\beta_{N_0}^{2n}$ are equal at $k = 0$, but they differ for

$k > 0$.
(4^*) The eigenstates with eigenvalues $\alpha_{N_0}^{2n}$ and $\beta_{N_0}^{2n}$ are degenerate at $k = 0$ but non-degenerate for $k > 0$.
(5) There is no flavor violation in the case $\Delta f = 0$, because the sfermion masses are degenerate.
(5) There is no flavor violation in the case $\Delta f = 0$, because the sfermion masses are equal.
(5^*) There is no flavor violation in the case $\Delta f = 0$, because the sfermions are degenerate with respect to mass.

In each of the original sentences, "degenerate" is being misused as a synonym of *equal*. Note that (3) is particularly problematic, as it is comparing two values obtained using two different theories.

To restate the main point of this section, the adjective *degenerate* is not synonymous with (nor in any sense similar to) *equal*. In particular, in the context of the eigenvalue problem, it describes a single eigenvalue, not the relation between eigenvalues. Thus, for example, the sentence

The eigenvalues ω_1 and ω_2 are degenerate.

does **not** mean that $\omega_1 = \omega_2$. Rather, it means that there are at least two eigenvalues corresponding to each of the two unequal eigenvalues ω_1 and ω_2.

43.3.2 Misused with other meanings

In addition to its mistaken use to express the meaning of *equal*, *degenerate* is commonly misused as a synonym of *identical*, *coincident* and *ambiguous*. Such mistaken use is demonstrated below.

(6) These effects are degenerate.
(6) These effects are identical.
(7) The positions of p_1 and p_2 are functions of α, and for $\alpha = n\pi$ ($n = 1, 2, 3 \cdots$), they are degenerate.
(7) The positions of p_1 and p_2 are functions of α, and for $\alpha = n\pi$ ($n = 1, 2, 3 \cdots$), they coincide.
(8) This identification of the source, however, is degenerate, since it does not uniquely specify the distance.
(8) This identification of the source, however, is ambiguous, since it does not uniquely specify the distance.
(9) Because soft modes are ignored, the prediction of the theory is degenerate for the two cases.
(9) Because soft modes are ignored, the prediction of the theory is identical for the two cases.

These uses of *degenerate* are even further removed from its proper use than those demonstrated by the previous examples.

43.3.3 Misused as a verb

Consider the following.

> (10) These eigenstates degenerate.
> (10) These eigenstates become degenerate.
> (11) At $\mu = 0$, the eigenvalues of the first and second excited states degenerate.
> (11) At $\mu = 0$, the eigenvalues of the first and second excited states are equal.
> (11*) At $\mu = 0$, the first and second excited states are degenerate.
> (12) This solution is identically zero for $d = 2$, and therefore, here the Gaussian fixed points degenerate.
> (12) This solution is identically zero for $d = 2$, and therefore, here the Gaussian fixed points coincide.

In these sentences, the intended meaning of "degenerate" is apparently that which it possesses as an adjective, but in the originals it is used as a verb. The verb form of this word expresses a meaning that is generally inappropriate in mathematics and physics, synonymous with *deteriorate* or *decline in quality*.

Chapter 44

depending

There are several common misuses of the participle *depending*. Here I treat the most serious of these.[1]

44.1 Inappropriate modification

The two most common types of problems I find with *depending* involve its inappropriate use in modification. These problems are demonstrated by the following examples.

> (1) In a given round, each species produces the offspring populating the next round depending on the overall fitness of the species.
> (1) In a given round, each species produces offspring populating the next round in numbers that depend on the overall fitness of the species.
> (1*) In a given round, each species produces offspring populating the next round, with the number produced determined by the overall fitness of the species.
> (1**) In a given round, each species produces offspring populating the next round in a manner that depends on the overall fitness of the species.
> (2) These are organized dynamically depending on the external input.
> (2) These are organized dynamically in a manner that depends on the external input.

The problem in (1) is that it is unclear to what noun the verb "depending" corresponds (i.e. with respect to what noun it expresses dependence). Grammatically, "depending on the overall fitness of the species" is a participle clause, which is used to modify a noun. In general, the noun modified by a participle clause is the subject of the action expressed by its participle. If we are to interpret (1) strictly, we can only conclude that this noun is either "species" or "offspring." The assertion of this sentence would then be that the *species depends on its fitness* or *the offspring*

[1] For most of the misuses illustrated in this section, *depending* is used to express the meaning of によって. While *depending* can indeed be used to with such a meaning, problems seem to result from the fact that the rules governing sentence structure are stricter for *depending* than for によって.

depend on its fitness. However, it is clear that neither of these expresses the intended meaning. Thus we can only conclude that the subject of the participle does not appear and therefore that the sentence is grammatically incorrect. (In fact it seems that perhaps the author meant to use this participle clause to modify the verb "produces." However, because a participle clause cannot act as an adverb, this too is grammatically mistaken. The second example here provides a clearer illustration of this type of error.) To correct this sentence, we must first determine what noun could appropriately act as the subject of "depending." Judging from the apparent intended meaning of the sentence as a whole, it seems that this noun should express either the *manner* or the *number* in which these offspring are left. Thus the two feasible ways to correct this sentence seem to be those given above.[2]

The second example represents a very common type of mistake. In the original, the participle clause "depending on the external input" is apparently being used to modify the verb "organized." However, as stated above, this type of grammatical structure is not possible.[3] The intended meaning here is evidently that the *organization* or *manner of organization* depends on the input.

In the following, I give illustrative examples in which "depending" is used either to modify the wrong noun or to modify a verb.

44.1.1 Modification of the wrong noun

(3) In this case, there are two kinds of equilibrium solutions, depending on the polymer lipid concentration and the tension.

(3) In this case, there are two kinds of equilibrium solutions, and that which represents the actual equilibrium is determined by the polymer lipid concentration and the tension.

(3*) In this case, there are two kinds of equilibrium solutions, which depend on the polymer lipid concentration and the tension.

(4) The application of the model is presently limited to antiferromagnetic phase transitions, but it is expected to exhibit more exotic behavior, depending on the values of the interaction coefficients.

(4) The application of the model is presently limited to antiferromagnetic phase transitions, but we believe that it can exhibit more exotic behavior for appropriately chosen values of the interaction coefficients.

(4*) The application of the model is presently limited to antiferromagnetic phase transitions, but we believe that it can exhibit more exotic behavior that depends on the interaction coefficients.

(5) Γ can be any Dirac matrix depending on which of these processes is considered.

(5) Γ can be any Dirac matrix, and that which it actually represents is determined by the process considered.

(6) There are two phases, depending on the magnitude of the radius of S.

[2] Note that the participle clause has been replace in (1) and (1**) by the relative clause "that depend(s)..."

[3] See Chapter 25 for discussion of a similar problem involving the expression *based on*.

(6) There are two possible phases, and that which appears is determined by the radius of S.

(6*) There are two phases, with each depending on the radius of S.

(7) One of the Milnor attractors is eventually selected, depending on initial conditions.

(7) One of the Milnor attractors is eventually selected, as determined by the initial conditions.

(8) We wish to determine the types of charged matter chiral superfields that appear in the four-dimensional effective theory depending on the brane configuration in the vacuum.

(8) We wish to determine how the types of charged matter chiral superfields appearing in the four-dimensional effective theory change with the brane configuration in the vacuum.

(8*) We wish to determine the types of charged matter chiral superfields that appear in the four-dimensional effective theory as a function of the brane configuration in the vacuum.

(8**) We wish to determine the types of charged matter chiral superfields that appear in the four-dimensional effective theory for different brane configurations in the vacuum.

(9) Depending on the location of the vacuum in the moduli space, there are various types of higher-dimensional theories.

(9) There are various types of higher-dimensional theories, each corresponding to a different location of the vacuum in the moduli space.

(9*) There are various types of higher-dimensional theories, whose properties are determined by the location of the vacuum in the moduli space.

(9**) There are various types of higher-dimensional theories, with the properties of each determined by the location of the vacuum in the moduli space.

(10) In this case, there are two repeatedly interchanging states, depending on the value of q.

(10) In this case, there are two states that are interchanged repeatedly, as determined by the value of q.

(10∗) In this case, there are two states that are interchanged repeatedly, in a manner that depends on the value of q.

(10**) In this case, there are two states that are interchanged repeatedly as the value of q changes.

In (3), “depending” seems to be modifying “kinds of solutions.” This implies that these kinds of solutions depend on the lipid concentration and the tension. Of course, this is possible, but if this were the intended meaning, the form in (3*) would be better. In fact, however, the intended meaning is that expressed by (3). As expressed there, that which depends on the lipid concentration and tension is the relation between these two kinds of solutions and the equilibrium state (that is, which of these kinds of solutions is realized in the equilibrium state), not the solutions themselves. (Note that we could change “is determined by” in (3) to *depends on* without changing the substance.)

The problem with (4) is in its implication that the "exotic behavior" depends on the interaction coefficients. In this sentence, "exotic behavior" refers to a certain type of behavior that appears for certain values of these coefficients, and thus the assertion here is logically flawed. That which depends on these coefficients is not this type of behavior itself but, rather, the *appearance* of this behavior. A second possible interpretation is that "depending" was meant to modify the verb "exhibit." In this case, the problem is of the second type discussed above.

The connotation of (5) is that the Dirac matrices depend on which process is considered. Obviously, however, this cannot be the case, as these matrices have well-defined, fixed forms. Instead, that which depends on this choice is the identity of the matrix that appears.

In (6), "depending" appears to be modifying "phases," but it is fairly evident that in the situation under consideration, that which depends on the radius of S is not these phases themselves but, rather, which of them is realized, as expressed by (6). (However, the interpretation expressed by (6*) is also possible.)

Note that (7) expresses the idea that these attractors depend on the initial conditions, but obviously that which depends on the initial conditions is the *selection* of the attractor.

In (8), "depending" seems to be modifying either the noun "types" or the verb "appear," but it is clear that that which depends on brane configuration is the *appearance* of these superfields.

Example (9) is similar to (3) and (6). In this case, however, as an interpretation of the original, the meaning expressed by (9*) is quite unnatural.

In (10), "depending" modifies "states." In fact, the resulting meaning, that these states depend on the value of q, is not unreasonable. However, it is evident that the intended meaning is not this but, rather, that the "interchange" of the states depends on the value of q.

44.1.2 Misused to modify a verb

(11) The first-order spatial derivative of the phase decreases linearly depending on the distance from α_0.
(11) The first-order spatial derivative of the phase decreases linearly with the distance from α_0.
(12) In this region, $\tilde{\gamma}$ increases exponentially depending on T.
(12) In this region, $\tilde{\gamma}$ is an exponentially increasing function of T.
(13) This theory describes the vortex distribution depending on the history of the externally applied fields.
(13) This theory describes the vortex distribution in terms of the history of the externally applied fields.
(13*) This theory describes the dependence of the vortex distribution on the history of the externally applied fields.
(14) The sizes of these compact spaces may differ depending on the directions of their respective shifts.
(14) The sizes of these compact spaces may differ, each depending on the direction of its shift.

(14*) The sizes of these compact spaces may differ because of the different directions of their respective shifts.
(15) In this case, the configurations are constrained strongly depending on the nature of the orientifold group.
(15) In this case, the configurations are constrained strongly by the nature of the orientifold group.
(15*) In this case, the allowed configurations are greatly restricted by the nature of the orientifold group.
(15**) In this case, the allowed configurations are largely determined by the orientifold group.
(16) The payoff matrix between any two players changes depending on the strategy chosen by each other player present.
(16) The payoff matrix between any two players depends on the strategy chosen by each other player present.
(17) During the development stage, each part of the organism is regulated depending on the state of the entire organism.
(17) During the development stage, each part of the organism is regulated in a manner that depends on the state of the entire organism.
(17*) During the development stage, the regulation of each part of the organism depends on the state of the entire organism.
(18) These external bodies interact with the system, depending on the control parameters χ_i.
(18) These external bodies interact with the system in a manner that depends on the control parameters χ_i.
(18*) The interaction of these external bodies with the system depends on the control parameters χ_i.
(19) Each player chooses their subsequent action depending on the state of the environment.
(19) Each player chooses their subsequent action in a manner that depends on the state of the environment.
(19*) Each player chooses their subsequent action in reference to the state of the environment.
(19**) The subsequent action chosen by each player depends on the state of the environment.

Here, "depending" is misused to modify the following verbs: (11) "decreases"; (12) "increases"; (13) "describes"; (14) "differ"; (15) "constrained"; (16) "changes"; (17) "regulated"; (18) "interact"; (19) "chooses."

44.2 Other misuse

Consider the following.

(1) Depending on x_0, the map $g(x)$ is different.
(1) The map $g(x)$ depends on x_0.
(1*) The /nature/form/ of the map $g(x)$ depends on x_0.

Here, that whose dependence is actually expressed by "depending" [i.e., "$g(x)$"] does indeed appear explicitly, and therefore this example differs from those studied to this point. The meaning of the original is the following: *The map $g(x)$ is different, and it depends on x_0.* Thus the two facts stated here regarding the map are seen as completely independent, and it is not clear with respect to what this map is "different."[4] The intended meaning, however, is apparently that expressed by (1) or (1*), which are very close in meaning.

In the following sentence, "depending" is used to modify an adjective. This is also grammatically incorrect, because, as stated above, this word cannot act as an adverb.

> (2) The location of this region is different depending on whether the system is subject to thermal fluctuations.
> (2) The locations of this region in the cases with and without thermal fluctuations are different.
> (2*) The location of this region depends on whether the system is subject to thermal fluctuations.
> (2**) The location of this region is changed by the presence of thermal fluctuations.

Finally, consider the following.

> (3) When we consider the confinement of an exciton in nanocrystals, there are two extreme cases depending on the ratio of the nanocrystal size to the effective exciton Bohr radius.
> (3) When we consider the confinement of an exciton in nanocrystals, there are two extreme cases, as characterized by the ratio of the nanocrystal size to the effective exciton Bohr radius.
> (3*) When we consider the confinement of an exciton in nanocrystals, there are two extreme cases, corresponding to two different regimes for the ratio of the nanocrystal size to the effective exciton Bohr radius.

Here, the use of "depending" is not grammatically incorrect, but the meaning it expresses is inappropriate. In this situation, the relation between the extreme cases and the ratio of the nanocrystal size to the Bohr radius is one of characterization or correspondence rather than dependence.

[4] The basic structure of the original sentence is $g(x)$ *is different*. The clause "depending on x_0" is a participle clause that modifies the subject of the main clause, "$g(x)$," and simply provides auxiliary information about it.

Chapter 45

despite

There are three types of problems I often encounter involving use of the preposition *despite*.[1] To understand these problems, let us first consider an example of its correct use.

> (1) Despite the simplicity of the Hamiltonian, no exact solution has been found, except in the one-dimensional case.

In general, *despite* is used to introduce a prepositional phrase that modifies a verb. This prepositional phrase describes a situation that, on its own, may lead one to believe that the action or state expressed by the verb would be unlikely.[2] Clearly this is the case in (1). Here, the object of "despite" is "simplicity." The prepositional phrase "despite the simplicity of the Hamiltonian" modifies the verb "has been found."

The most common problems involving *despite* that I encounter are demonstrated by the following sentences.

> (2) The neutrino's Majorana masses can be unambiguously determined despite all the members in **27** of each generation are assigned to the same $U(1)_X$ charge.
> (2) The neutrino's Majorana masses can be unambiguously determined despite the fact that all the members in **27** of each generation are assigned to the same $U(1)_X$ charge.
> (3) Despite that there are infinitely many solutions for $\epsilon = 0$ and $\epsilon = 1$, there is only solution for $\epsilon \in (0, 1)$.
> (3) Despite the fact that there are infinitely many solutions for $\epsilon = 0$ and $\epsilon = 1$, there is only solution for $\epsilon \in (0, 1)$.
> (3*) Although there are infinitely many solutions for $\epsilon = 0$ and $\epsilon = 1$, there is only solution for $\epsilon \in (0, 1)$.

[1] For discussion of the closely related expression *in spite of*, see Chapter 66.

[2] Although *despite* can usually be translated as にもかかわらず, the former can be used with fewer kinds of structure than the latter. This difference seems to be one of the causes of the mistakes involving *despite*.

In (2) note that "despite" is being used to introduce an independent clause.[3] Grammatically, this is not allowed, because *despite* is a preposition, which can only introduce a prepositional phrase. A prepositional phrase necessarily has the form *[preposition] + [object]*, where this *[object]* is an expression that acts grammatically as a noun. However, an independent clause as a whole cannot act in this way, and thus if we were to use a preposition to introduce an independent clause, the only possibility would be that some noun within this clause acts as the object of the preposition. It would thus be required for this noun to somehow 'split' its grammatical role within the sentence – as part of the prepositional phrase and as part of the independent clause. In general, such grammatical structures are not possible in English. In (2), the noun "members" seems to be acting as both the object of the prepositional phrase "despite..." and the subject of the clause "all..."

Example (3) illustrates a different type of problem. Here, "despite" introduces a noun clause,[4] "that there are...$\epsilon = 1$." Because a noun clause acts as a noun, in this case there is no grammatical problem. Instead, here the problem is simply one of awkwardness. As this sentence demonstrates, using a clause as the object of a preposition usually results in an unnecessarily confusing construction. In (3), the construction is made more transparent by using "fact" as the object of "despite." In this rewritten version, the noun clause "that there are...$\epsilon = 1$" acts as a relative clause, referring to "fact."[5]

The third common problem I find involving *despite* is demonstrated by the following.

> (4) Despite of these simplifying approximations, the homogeneous LR equations cannot be treated analytically
>
> (4) Despite these simplifying approximations, the homogeneous LR equations cannot be treated analytically

It seems that this problem results from confusion of *despite* with *in spite*. Note that both "of" and "despite" are prepositions. Except in a few very special cases, prepositions cannot appear consecutively.

[3] An independent clause (also called a 'main clause') can stand on its own as a complete sentence. Note that this is obviously true of "all the members...charge."

[4] A noun clause begins with *that*, a question word (*when*, *why*, *how*, etc.), *if* or *whether*. Like an independent clause, a noun clause contains a finite verb (and thus is a type of 'finite clause'), but unlike an independent clause, it cannot stand on its own as a complete sentence. Rather, it functions grammatically as a noun.

[5] See Section 1 of Chapter 66 for related discussion.

Chapter 46

difference

46.1 *difference of*, *difference in*, *difference between*

I often find problems involving the use of prepositions with *difference*. In this section I give some preliminary discussion of this use.

In modern English, the three prepositions most commonly used with *difference* are *between*, *of* and *in*.[1] I now give a brief comparison of the proper uses of these three.

46.1.1 *difference of*

The expression *difference of* can be used in a number of ways. Here I identify what I believe to be the five most common of these, as demonstrated by the following examples.

> (1) There is a difference of approximately 1.2 MeV between the two predictions.
> (2) The difference of precision for these two methods is negligible.
> (3) The difference of the present approach is that it does not rely on the integrability of F.
> (4) This is simply a difference of theory and application.
> (5) The difference of the functions f_1 and f_2 is written Δf.

In the first use, illustrated by (1), the object of the preposition "of" expresses a quantity (here "1.2 MeV"). This quantity represents the amount by which the two things under consideration differ. In the second use, seen in (2), "difference of" is synonymous with *difference with regard to*. In this case, the object of the preposition "of" (in (2), "precision") represents the property or attribute with regard to which the comparison is being made. The implication of (2) is that there may be other ways in which these two methods differ significantly, but with regard to precision, they are essentially the same. In the use demonstrated by (3), the "difference" in question is regarded more as a property of a single thing than as something characterizing

[1] The prepositions *from* and *with* can also be used with *difference*, but problems involving their use are relatively uncommon, and therefore I do not consider them here.

the relation between two things. In this example, “the difference of the present approach” means *that characteristic which makes the present approach different from all others*. In the fourth use, demonstrated by (4), the object of the preposition “of” presents the things being compared themselves. In such usage, *difference* does not refer to a specific, concrete disparity but, rather, to something more general and abstract. This point warrants emphasis: In most cases, the construction *the difference of A and B* can only be used when the comparison between A and B is of an abstract nature. (The notable exception to this general rule is illustrated by (5).) One of the most common misuses of *difference of* is that in which it is used in this construction when the intended comparison is of specific, concrete qualities, attributes, phenomena, etc. Contrastingly, note that in (4), “difference of” is very natural, because it is being used with regard to two things that are indeed quite abstract. A somewhat different shade of meaning that can be expressed with this fourth type of usage is exemplified by the following.

> (6) This difference is like the difference of modern chemistry and medieval alchemy.

Here, “difference” chiefly carries a meaning of degree or amount. In other words, the main assertion of this sentence is that “this difference” and the “difference of modern chemistry and medieval alchemy” are of similar ‘magnitudes’. In this sense, this use of “difference of” is similar to that demonstrated by (1). However, in (6), there is an implied meaning that the differences mentioned here are similar in a qualitative as well as quantitative sense. This can be understood by noting that if “difference” were replaced by *relationship*, the substance of this sentence would be changed little. In (5), “difference” refers to the mathematical operation of subtraction. The case in which *difference* has this meaning represents the only significant exception to the rule stated above regarding the construction *the difference of A and B*.

46.1.2 *difference in*

There are two main uses of *difference in*, as demonstrated below.

> (7) For these two approaches there is a fundamental difference in the role of the operator τ.
> (8) The small difference in the value of α is unimportant.

The meaning of “difference in” in (7) is identical to that of “difference of” in (2), above. When the intention is to specify the attribute with respect to which a comparison is being made, *difference of* and *difference in* are generally interchangeable. In the use demonstrated by (8), “difference in” is synonymous with *change in*. This is more obvious in the following.

> (9) This change leads to a small difference in the neutrino sector.

46.1.3 *difference between*

There is just one normal use of *difference between*, illustrated by the following.

(10) The most significant difference between these equations is that in (1.2) the gradient in the second term on the left-hand side acts only on ϕ, while in (4.3) it acts on both ϕ and ψ.

As demonstrated by this sentence, "difference between" is used in referring to specific, concrete differences. This sentence should be compared with (4), (5) and (6) above, in which "difference of" is employed in a grammatically identical manner but with different meaning. It should be noted that because of this difference in meaning, *differences of* is rare, whereas *differences between* is very common.

46.2 *difference between...of* vs. *difference of...between*

One problem I frequently encounter involving preposition choice with *difference* is misuse of the construction *difference of...between*, demonstrated by the following.[2]

(1) The difference of the contributions between the adiabatic and isocurvature fluctuations is significant in this regime.

The construction *difference of + [noun] + between...* illustrated here is very commonly misused in place of *difference between + [noun] + of...*.[3] The above is a typical such example. Its intended meaning is correctly expressed as follows.

(1) The difference between the contributions of adiabatic and isocurvature fluctuations is significant in this regime.

Let us compare the above two sentences. In (1), "difference of" could be interpreted only with the meaning demonstrated by (1) or (2) of the previous section.[4] In the first case, the interpretation would be that these two types of fluctuations are different and the amount by which they differ is "the contributions." This is nonsense. In the second case, the interpretation would be that these two types of fluctuations are different and this difference *regards* "the contributions." While such a situation is possible, this is not the meaning that the author wished to convey. The intended meaning, that the two "contributions" are different, is expressed by (1).

With respect to the problem considered here, it is most important to realize that the meaning of the construction

difference of + [noun 1] + between + [noun 2] + and + [noun 3]

is either that *[noun 2]* and *[noun 3]* are different and this difference is *[noun 1]* or that *[noun 2]* and *[noun 3]* are different and their difference is with regard to *[noun 1]*. By contrast, the meaning of

[2] Of course, *difference of...among* is similarly problematic.

[3] It seems that perhaps the source of this problem is the direct translation Japanese expressions. For example, directly translated, 男女間における平均寿命の差 would become something like *the difference of average life span between men and women*, rather than the correct form, *the difference between the average life spans of men and women.*

[4] Note that "for" in (2) could be replaced by *between* without changing the meaning of the sentence.

difference between + [noun 1] + of + [noun 2] + and + [noun 3][5]

is that the *[noun 1]* of *[noun 2]* and the *[noun 1]* of *[noun 3]* are different. Very often, the former construction is mistakenly used in place of the latter.

The following are additional typical examples.

(2) The difference of the predictions between the theory we propose and that of Blair et al. is significant.
(2) The difference between the predictions of the theory we propose and that of Blair et al. is significant.
(2*) The predictions of the theory we propose and that of Blair et al. differ significantly.
(3) The difference of the amplitudes between the isospin 3/2 and 1/2 channels grows as α approaches 1.
(3) The difference between the amplitudes of the isospin 3/2 and 1/2 channels grows as α approaches 1.
(4) The difference of the merging process between case 1 and case 2 can be understood as follows.
(4) The difference between the merging processes of case 1 and case 2 can be understood as follows.
(4*)The difference in the merging process for cases 1 and 2 can be understood as follows.
(5) The difference of the calcium sensitivity between the above cationic channel and the AHP channel can be used effectively.
(5) The difference between the calcium sensitivities of the above cationic channel and the AHP channel can be used effectively.

Note that the intended meanings here are that the "predictions" are different, the "amplitudes" are different, the "processes" are different, and the "sensitivities" are different.

46.3 Other misuses of *difference of*

As mentioned in Section 1, misuse of *difference of* in the construction *the difference of A and B* is quite common. The following are typical.

(1) The difference of these types of behavior is most prominent in the region of large mass.
(2) Here we point out the difference of the argument given here and that given for random surfaces.
(3) The main difference of the two sets of curves is that all members of the first set decay exponentially and all members of the second set decay no more rapidly than $\sim x^{-2}$.

[5] It should be noted that this is just one example of the more general construction *difference between + [noun 1] + [preposition] + [noun 2] + and + [noun 3]*. Almost any preposition can be used in this construction.

(4) For simplicity, we ignore the differences of the sizes along various directions in the compact space.
(5) This difference results from the difference of assumption 1 and assumption 2.
(6) The difference of these two transformations is somewhat subtle.
(7) The difference of the merging processes with and without the second interaction term is displayed in Fig. 2.
(8) The difference of phenotype C and phenotype D is striking.
(9) Although the difference of their boundary conditions is very small, the two systems behave entirely differently.
(10) There are two conceptual differences of these formulations.

In each of these sentences except (4), "difference of" should be replaced by *difference between*. In (4), "differences of" should be replaced by *differences among*.

46.4 Misuse of *difference in*

Before examining the misuse of *difference in*, let us first consider some additional examples of its proper use.

(1) The difference in strength among these fields is large.
(2) The differences between these methods result from a difference in point of view.
(3) A difference in the degree of folding distinguishes the SS and SP phases.

In (1), note that the noun "strength" is singular. This is because this word is being used to represent the abstract concept of *strength*, rather than the actual, specific strength of any of the fields in question, and the prepositional phrase "in strength" is used to identify the context of the statement. Thus the meaning of this prepositional phrase is similar to that of "with regard to strength" in the following sentence: *With regard to strength, the difference between these fields is large.* The situations in (2) and (3) are essentially the same. Now consider the following.

(4) There are differences in the $\sigma \to -\infty$ and $\sigma \to \infty$ forms of these solutions.

In this case, the object of the preposition "in" is the plural "forms." The reason for this, however, is not that this word is referring to the specific asymptotic forms of each solution but, rather, that these solutions are being compared with regard to the abstract property of *form* in two different contexts, the $\sigma \to -\infty$ limit and the $\sigma \to \infty$ limit. (Indeed, "in the $\sigma \to -\infty$ and $\sigma \to \infty$ forms" here means *in the $\sigma \to -\infty$ form and the $\sigma \to \infty$ form*.)

I often find problems with *difference in* when it is meant to be used as in the examples above. These problems are illustrated by the following sentences.

(5) The difference in final values between these two methods is negligible.
(5) The difference between the final values obtained with these two methods is negligible.

(6) We can thus conclude that the difference in effects between the first and second terms is due to their difference in symmetry.
(6) We can thus conclude that the difference in effect between the first and second terms is due to their difference in symmetry.
(6*) We can thus conclude that the difference between the effects of the first and second terms is due to their difference in symmetry.
(7) The difference in m_1 from m_2 is negligible.
(7) The difference between m_1 and m_2 is negligible.

In (5) and (6), as in (1)–(3), because of this use of "difference in," "values" and "effects" should be interpreted as abstract nouns, but the fact that they are plural implies, to the contrary, that they refer to certain specific values and effects. The roles of "values" in (5) and (5) differ: While in (5) it is (incorrectly) used to identify the context of the assertion, in (5) it represents the two things that differ. (In its most natural interpretation, (5) expresses the meaning that the two "methods" differ.) In (6), note that the phrase "difference in symmetry" is correct, because here "symmetry" is used in an abstract sense. Because it contains several mistakes, (7) is very difficult to interpret.

Chapter 47

different

The adjective *different*, like the noun *difference*, often involves a misuse of prepositions. The examples presented in this chapter illustrate the most serious misuses.

47.1 *from* and *than*

The expressions *different from* and *different than* are both possible.[1] In general, *different from* is preferable when the intended meaning is simply that the things compared are distinct or separate, while *different than* is more suitable when the intended meaning is that they are dissimilar. For this reason, the following sentences express somewhat different meanings.

> (1) This planet is different from that mentioned by James and Powers.
> (2) This planet is different than that mentioned by James and Powers.

The meaning of (1) appears to be simply that these planets are distinct, while (2) is evidently a statement about the conditions on the two planets. Because of this difference in meaning, it is more natural to use modifiers that express degree, like *quite* or *very*, with *different than* than with *different from*.

The situation regarding the following sentence is somewhat different. This demonstrates how a blind application of the guideline described above can lead to problems.

> (3) The elastic effect in this system gives a different contribution from that in the system considered above.
> (3) The elastic effect in this system gives a different contribution than that in the system considered above.
> (3*) The elastic effect in this system gives a contribution that differs from that in the system considered above.

[1] The expression *different to* is also sometimes used. According to The American Heritage Dictionary of the English Language [1], *different to* is chiefly British English, while *different than* is chiefly American English. However, according to the Oxford English Dictionary [4], in present-day English *different to* is used colloquially but is considered by many experts to be incorrect.

The problem with the original here is that, while "from" is meant to form a set with "different," it seems to form a set with "contribution." This results in an awkward sentence. There is no such problem in (3), because "contribution than" cannot be interpreted as forming a set. Another possibility is presented by (3*).

47.2 Misuse with *between* and *among*

I often find the prepositions *between* and *among* used with *different*. This usage should be strictly avoided. The following are illustrative examples.

(1) This reflects the different spatial dependence between f_1 and f_2.
(1) This reflects the difference between the spatial dependences of f_1 and f_2.
(1*) This reflects the difference in spatial dependence for f_1 and f_2.
(1**) This reflects the fact that the spatial dependences of f_1 and f_2 differ.
(2) The lifetime is quite different between the two cases.
(2) The lifetimes in the two cases are quite different.
(2*) The lifetimes differ significantly for the two cases.
(3) This value is different among the four models.
(3) This value is different for each of the four models.
(3*) This value differs among the four models.
(4) The value of α is different between method 1 and method 2.
(4) The values of α obtained with methods 1 and 2 are different.
(4*) Methods 1 and 2 yield different values for α.

47.3 Misuse with *from*

The expression *different from* forms an adjective-preposition set. It is best to avoid splitting this set.[2] The following are typical examples of such problematic construction.

(1) This gives a different spin dependence from the standard one.
(1) This gives a spin dependence that differs from the standard one.
(2) These states have different hole structure from that in the $\tau > 0$ case.
(2) The hole structure of these states /differs/is different/ from that in the $\tau > 0$ case.
(2*) These states have hole structure that differs from that in the $\tau > 0$ case.
(3) Each has a different duty ratio from the isolated model.
(3) Each has a duty ratio that differs from that of the isolated model.
(3*) The duty ratio of each differs from that of the isolated model.
(4) The conserved system has very different properties from the non-conserved system.
(4) The properties of the conserved system differ greatly from those of

[2] For similar discussion see Chapters 37, 93 and 113.

the non-conserved system.
(4*) The properties of the conserved and non-conserved systems differ greatly.
(5) These functions have very different symmetry properties from the solutions to (3.1).
(5) The symmetry properties of these functions differ greatly from those of the solutions to (3.1).
(5*) The symmetry properties of these functions are quite different from those of the solutions to (3.1).

Splitting the pair *different from* almost always results in awkwardness and, more seriously, often results in ambiguity. Let us consider (1). The meaning expressed by this sentence seems to be that the spin dependence of interest *comes from* the "standard one." The intended meaning, however, is that this spin dependence *differs from* the "standard one." The problems with the other examples are similar.

47.4 Misused to mean *in contrast*

Sometimes I find *different* used in the following way.[3]

(1) Different from the slightly relativistic case, here we cannot ignore the higher-order terms in β.
(1) In contrast to the slightly relativistic case, here we cannot ignore the higher-order terms in β.

Different is an adjective, but here it is being used as an adverb, modifying the verb "cannot ignore."

[3]The example here demonstrates a difference between *different from...* and ... と違って.

Chapter 48

difficult

48.1 Modification of the wrong type of action

48.1.1 Examples

Usually, the adjective *difficult* is used to describe an action or something that clearly involves an action. Its most common type of usage is exemplified by the following.

(1) It is difficult to imagine how this effect can become negligible.
(2) That book is difficult to read.
(3) These problems are indeed difficult.

The connotation of (1) is that the way in which this effect becomes negligible is difficult for *us* to imagine. As illustrate by this example, in general, the action corresponding to *difficult* is something that a person or other animal does (or attempts to do). The situation is similar in (2). The most important points to be noted with regard to these examples are that those things being described as "difficult" are the actions of "imagining" and "reading" and that in each case, it is a human that experiences this difficulty. Example (3) is somewhat different, as in this case no action is explicitly expressed. However, here there is a clearly implied action, namely that of solving these problems, and thus in this sentence too, the action regarded as "difficult" is unambiguously something done by a human. In a situation like this, because the intended meaning is obvious, it is not necessary to state the action explicitly. (Note that, in fact, "to read" could be deleted from (2) without creating any problem of ambiguity.[1]) The reason that, in the presently considered usage, *difficult* is generally only used to describe the action of a person (or another animal) is that a state of difficulty is something that can arise only in the situation that some action is to be carried out by an agent with a self-motivated purpose. For this reason, when this word is used with regard to some other kind of action or effect, the result is usually quite unnatural or even illogical. Of course, this is sometimes done for literary effect, but in scientific writing it is best avoided.

Now, let us contrast the above examples with the following.

[1]However, in something like *This equation is difficult*, this is not the case. The intended meaning here is quite unclear, because we can only guess with regard to what action this equation is "difficult." (For example, this could be solving, deriving, understanding, reducing...)

(4) It seems difficult that this model would exhibit such behavior for any initial conditions.
(4) It seems unlikely that this model would exhibit such behavior for any initial conditions.
(5) It is difficult that the gauge coupling does not diverge until the Planck scale.
(5) The gauge coupling likely diverges above the Planck scale.
(5*) It is very likely that the gauge coupling diverges above the Planck scale.
(6) Contraction of the gel as a whole is difficult due to its interaction with the walls of the container.
(6) The gel is prevented from contracting as a whole by its interaction with the walls of the container.
(6*) Interaction with the walls of the container prevents the gel from contracting as a whole.
(6**) Contraction of the gel as a whole is /precluded/prevented/made unfeasible/ by its interaction with the walls of the container.
(6***) Contraction of the gel as a whole is not allowed, due to its interaction with the walls of the container.
(7) Such a pairing excitation seems difficult.
(7) Such a pairing excitation seems unlikely.
(7*) Such pairing excitation seems difficult to realize.
(8) The pion contribution is small and difficult to be extracted.
(8) The pion contribution is small and difficult to extract.
(9) This is difficult to be evaluated.
(9) This is difficult to evaluate.
(10) Such behavior of the model is indeed pathological, and difficult to be realized in any given numerical simulation with randomly chosen initial conditions.
(10) Such behavior of the model is indeed pathological and unlikely to be realized in any given numerical simulation with randomly chosen initial conditions.
(10*) Such behavior of the model is indeed pathological, and it would be difficult to realize in any given numerical simulation with randomly chosen initial conditions.

In each of the problematic examples here, the action described as "difficult" – "exhibiting," "not diverging," "contraction," "seeming," "being extracted," "being evaluated," and "being realized" – is not an action performed by a person. Note that for (8)–(10), the problem can be solved by simply changing the passive verbs "be extracted," "be evaluated" and "be realized" to the active forms "extract," "evaluate" and "realize." In (4)–(7), "difficult" is being used to express a meaning something like *unlikely*. In fact, however, *difficult* possesses no such meaning.

48.1.2 Grammatical considerations

The problems with the above examples can be better understood if we consider them from a somewhat more grammatical point of view. There are three important points here.

First, note that the construction *[noun] + [verb] + difficult that...* (as illustrated by (4) and (5)) is somewhat rare, and in scientific writing it is particularly unusual. The reason for this is that such a construction can only be used when the meaning of *difficult* is something like *trying* or *unpleasant*, as in the following: *It is difficult that I must watch her grow old.*

Second, a construction of the form *[noun] + [verb] + difficult* that is *not* followed by an infinitive verb form (as illustrated by (4)–(7)) is possible only when *[noun]* represents an action performed by a person (or another animal), as in the following: *Solving these equations is difficult*; *Properly taking these effects into account is more difficult in this case.*

Third, in the construction *[subject] + [verb] + difficult + to + [infinitive verb]*, *[infinitive verb]* must express an action performed by a person. There are two possible types of patterns here, that with a so-called empty subject, as demonstrated by (1), and that with a 'normal' subject, as demonstrated by (2). In general, the role of the empty subject is played by the pronoun *it*. This is the case in (1), where the infinitive verb is "imagine," and its object, "how," appears in the adjective clause "difficult to..." In the second case, the subject, "book," also acts implicitly as the object of the infinitive verb "read." In both of these cases, the adjective clause "difficult to..." modifies the subject. These sentences should be compared with (1) in the next section, in which the adjective clause "difficult to..." modifies the direct object.

48.2 Other problems

The following sentences demonstrate different types of problems involved with the use of *difficult*.

> (1) These factors make the present method difficult to draw any definite conclusions.
> (1) These factors make it difficult to draw any definite conclusions with the present method.
> (2) This very direct method is difficult to produce results without considerable calculational effort.
> (2) It is very difficult to produce results using this very direct method without considerable calculational effort.
> (3) This interpretation is difficult.
> (3) This interpretation is problematic.
> (3*) It is difficult to justify this interpretation.
> (3**) It is difficult to arrive at this interpretation.
> (3***) This interpretation is difficult to understand.
> (3****) This interpretation is complicated.

(4) This is one of the most difficult observables in cosmology.
(4) This is one of the most difficult to measure observables in cosmology.

The action in (1) described by "difficult" is "drawing." This is in fact something that a person does, and thus the problem here is not like that in the previous examples. Note that here, "difficult to...conclusions" is an adjective clause modifying "method." However, grammatically, this implies that "method" acts as the object of the infinitive verb "draw." Hence, the sentence corresponding to this adjective clause is *We draw the method*, which is clearly nonsense.[2] The problem in (2) is very similar to that in (1). The problem with (3) is like that discussed in the first footnote of this chapter – simply a lack of information. The original leaves the reader wondering what is difficult about this interpretation. The problem with (4) is similar.

[2]Comparing (1) with the correct sentence *These factors make the present model difficult to apply* makes this point more clear. Here, the sentence corresponding to the adjective clause is *We apply the model*.

Chapter 49

direction

The noun *direction* should not be used to mean *approach*, *point of view*, *line of reasoning*, or anything similar to these. The following demonstrate misuse of this kind.[1]

(1) Similar directions for the treatment of this problem have been attempted.
(1) Similar approaches for the treatment of this problem have been attempted.
(1*) Similar points of view for the treatment of this problem have been employed.
(2) We follow a different direction in the present study.
(2) We take a different approach in the present study.
(2*) We follow a different line of reasoning in the present study.
(3) We employ a new direction to study this problem.
(3) We employ a new /point of view/method/approach/ to study this problem.
(4) We are now studying this direction of establishing such formalism.
(4) We are now studying this /approach/line of reasoning/method/ for establishing such formalism.
(5) Study in this direction has led to several interesting results.
(5) This /line of study/approach/type of investigation/ has led to several interesting results.
(5*) Investigation along this line has led to several interesting results.

In all of the above original sentences, there is a problem of meaning involved with the use of "direction." Specifically, although when used in the presently considered

[1] The misuse considered here apparently results from the mistaken translation of 方向. Obviously there are situations in which 方向 corresponds to *direction*, but it is important to understand when such a translation is inappropriate. For example, while a direct translation of こうした方向を研究する would perhaps be *We investigate this direction*, this English expression is quite unnatural. Here, something like the following might be appropriate: *We investigate this /point/matter/line of reasoning/approach/method/*. As an additional example, consider the following: こうした現象をどう理論化していけばよいのだろうか。ここではその方向を議論する. The most appropriate translation of the second sentence here would perhaps be *Here we discuss /this matter/this topic/this point/this problem/such a possibility/*.

context, direction is something that *characterizes* or is *possessed by* an investigation or method, the use of this word in (1)–(5) results in the inappropriate implication that it is something that is *employed by* an investigation or method.

The correct use of *direction* is illustrated by the following.

> (6) We hope that this finding gives new direction to the study of high T_c superconductivity.
> (7) This suggests that we should consider a fundamental change in the direction of our research.
> (8) There has been significant effort in the direction of a complete reinterpretation of quantum mechanics.
> (9) We are presently seeking new directions of inquiry.
> (10) These experimental results should provide new direction to theoretical studies of biomotors.
> (11) The direction taken by science is ever changing.

In these sentences, "direction" is used with various meanings. These meanings can be understood from the correspondences of the following synonymous expressions: in (6), "direction" $\leftrightarrow$ *guidance*; in (7), "direction of our research" $\leftrightarrow$ *goal toward which our research is directed* or */aim/focus/ of our research*; in (8), "in the direction of" $\leftrightarrow$ *aimed at* or *with the goal of*; in (9), "directions" $\leftrightarrow$ *fields*, *lines* or *topics*; in (10), "direction" $\leftrightarrow$ *guidance*; in (11), "direction" $\leftrightarrow$ *path*, "direction taken by" $\leftrightarrow$ *aim of*, or "direction taken by science" $\leftrightarrow$ *apparent goal at which science is directed.*

Chapter 50

discussion and *discuss*

50.1 Problem of meaning

The noun *discussion* and the verb *discuss* are greatly overused and quite often misused by Japanese authors. Most often, they are incorrectly used in situations that *analysis/analyze*, *treatment/treat*, *investigation/investigate*, *examination/examine*, *study/study*, *consideration/consider*, *demonstration/demonstrate*, *argument/argue*, *proof/prove*, *derivation/derive* or *report/report* would be most appropriate.[1] In their proper usage in scientific writing,[2] *discussion* and *discuss* are normally used with regard to discourse that simply presents and elucidates information and concepts concerning some topic. In scientific works, these words should not be used in reference to the derivation of what would be considered a result. In particular, it is inappropriate to refer to something composed of mathematical analysis, proofs, derivations, calculations or formal logical reasoning as 'discussion'. Further, as a general rule, these words should be avoided in reference to systematic arguments, analysis and investigations of all kinds. Usually, *discussion* and *discuss* are used with regard to something that is more informal, supplementary and explanatory, often being preparatory, summaratory, tentative, hypothetical, prospective, parenthetic

[1]Other words for which they are inappropriately used include the following: *show*, *conclude*, *mention*, *point out*, *allude to*, *inquire*, and their noun forms. While these and the words given above are, to varying degrees, similar in meaning to *discuss* and *discussion*, they are certainly not synonymous.

[2]Among the definitions of *discussion* given in dictionaries, there are a number that are relevant to its usage in present day scientific writing. The American Heritage Dictionary of the English Language [1] gives two particularly appropriate definitions, attributed to *discussion* as a synonym of *exposition*: *a setting forth of meaning or intent* and *a statement or rhetorical discourse intended to give information about or an explanation of difficult material.* The main point of these definitions is the presentation, explanation and interpretation of ideas and information. Relevant definitions with slightly different emphases are also given in WordNet [6], *an extended communication dealing with some particular topic*, in the Encarta World English Dictionary [2], *spoken or written examination of topic: a detailed consideration or examination of a topic in writing or speech*, and in the Merriam-Webster Online Dictionary [3], *a formal treatment of a topic in speech or writing.* From the last two of these definitions, it is seen that *discussion* can be used in reference to what would be considered an examination or treatment of a topic. However, as the first two definitions reveal, this usage is most natural when the purpose of this examination or treatment is to present information and to explain ideas, not to derive results.

or somewhat peripheral to the main line of reasoning.[3]

The overuse of *discussion* and *discuss* results in imprecise and misleading statements, as well as poor style. In most cases that I find these words used, there is a more appropriate and more precise expression that could be used. Generally, if the intended meaning can be expressed by one of the terms listed above, it is almost certain that that word would be more appropriate than *discussion* or *discuss*.

Consider the following examples.

> (1) Through discussion similar to that above, we can derive an equation describing the asymmetric system as well.
> (1) Through analysis similar to that above, we can derive an equation describing the asymmetric system as well.
> (1*) Through computations similar to those above, we can derive an equation describing the asymmetric system as well.
> (2) In this paper we discuss that such solutions exist only when $\rho > 0$.
> (2) In this paper we /show/prove/demonstrate/argue/ that such solutions exist only when $\rho > 0$.
> (3) In this paper we discuss the stability of this solution in several regimes.
> (3) In this paper we /analyze/examine/investigate/study/ the stability of this solution in several regimes.
> (4) A previously unknown effect is found through the detailed discussion of this perturbation given in the next section.
> (4) A previously unknown effect is found through the detailed /analysis/study/investigation/treatment/ of this perturbation given in the next section.
> (5) In the following section, we discuss that this type of analysis actually misses the mark, and that the proper treatment begins from an entirely different starting point.
> (5) In the following section, we /argue/demonstrate/show/point out/ that this type of analysis actually misses the mark, and that the proper treatment begins from an entirely different starting point.
> (6) This is a standard technique to discuss chaos.
> (6) This is a standard technique to /study/investigate/analyze/ chaos.
> (7) Similar discussion near other resonance points yields similar conclusions.
> (7) Similar analysis applied to the behavior exhibited near other resonance points yields similar conclusions.
> (7*) A similar treatment applied to the behavior exhibited near other resonance points yields similar conclusions.
> (8) In a previous work [1], we discussed black hole evaporation based on a numerical model.
> (8) In a previous work [1], we /studied/investigated/treated/analyzed/examined/

[3] It seems that perhaps the main source of the misuse treated in this section results from translation of 議論する, 論じる, 検討する and 吟味する as *discuss*. While there are situations in which such translations are appropriate, there are probably more in which they are not.

black hole evaporation using a numerical model.
(9) In order to make a quantitative discussion of these interactions in nuclei, more precise experimental data are necessary.
(9) In order to carry out a quantitative /investigation/analysis/examination/study/ of these interactions in nuclei, more precise experimental data are necessary.
(10) It is necessary to discuss the basin of attraction in order to fully understand a network's characteristics.
(10) It is necessary to /analyze/study/treat/investigate/ the basin of attraction in order to fully understand a network's characteristics.
(11) In studying the retrieval process, we mainly discuss the time evolution of these parameters.
(11) In studying the retrieval process, we mainly /consider/investigate/analyze/ the time evolution of these parameters.
(12) We can also perform discussion of the retrieval process in this case.
(12) We can also /carry out analysis of/investigate/study/examine/analyze/ the retrieval process in this case.
(13) We next discuss the linear stability of the flat membrane and the effect of thermal fluctuations.
(13) We next /investigate/analyze/ the linear stability of the flat membrane and the effect of thermal fluctuations.
(14) Since our model consists of a single membrane, we cannot use it to discuss defect structures in multilamellar systems.
(14) Because our model consists of a single membrane, we cannot use it to /model/study/investigate/examine/ defect structures in multilamellar systems.
(15) Equation (1.1) has been discussed by many people.
(15) Equation (1.1) has been /studied/investigated/analyzed/considered/treated/ by many people.
(16) Quantum mechanics discussed until now does not provide an interpretation of this behavior.
(16) Quantum mechanics in its present form does not provide an interpretation of this behavior.

I now discuss each of the above examples individually. The problem with (1) is that we do not derive an equation through discussion alone. In general, this requires some mathematical analysis or computations. Implied by the use of "discuss" in (2) is that in the present paper, no explicit mathematical results are obtained with regard to the existence of the solutions in question, and in particular, neither their existence nor non-existence is proven. The meaning of this sentence seems to be that the authors simply make comments about the existence of these solutions. Of course, this too is possible, but it is more likely that the actual situation is that described by (2). Similarly, (3) implies that no explicit results are obtained and that the paper only gives some general discussion of the stability in question. The problem in (4) is similar to that in (1). The point here is that, in general, mathematical behavior is usually not something that can be understood through discussion alone. In (5),

the problem is that the discourse described here is more precisely referred to as an "argument" or "demonstration" than a "discussion." The problem with (6) is that something termed a 'technique' would generally not be employed in discussion, and thus, apparently, here the term "discussion" is inappropriate. The connotation of (7) is that the "discussion" referred to actually appears near the "resonance points." The implication of (8) seems to be that the "discussion" is not based on the results derived from the numerical model but on the model itself. However, while it is natural to think of discussion as being based on some results or an analysis, investigation, etc., as being based on a model, it is quite unnatural to think of discussion as being based on a model.[4] Example (9) is problematic for two reasons. First, the expression "quantitative discussion" is something of a contradiction in terms. Second, in general, *discussion* cannot act as the direct object of the verb *make*. (In correct usage, the verbs most commonly used with *discussion* in this way are probably *give* and *present*.) Example (10) is unnatural because, usually, such an "understanding" does not result from mere discussion. The implication of (11) is that this "studying" of the retrieval process consists mainly of discussion. If this were the case, however, it would be inappropriate to refer to this as "studying," and something like *considering* should be used instead. It seems, however, that the intended meaning is that expressed by (11). It is not possible to "perform discussion," as stated in (12). Example (13) implies that the deliberation which follows is not an investigation of the linear stability of the membrane but simply some comments about it. In general, we do not use a model for the purpose of discussing something, and for this reason (14) is very strange. Example (15) suggests that the people referred to have made some statements about the equation in question but that none of them has actually investigated its behavior or obtained any concrete results in its regard. The intention of (16) was to make a statement concerning the nature of the theory of quantum mechanics as it relates to the "behavior" under consideration, but in fact it does not express such a meaning.

Below I give a number of additional examples without comment.

(17) This close agreement justifies our discussion.
(17) This close agreement provides support for the validity of our /treatment/approach/assumption/derivation/analysis/.
(18) This phenomenon is discussed using the modified interactions with the original model.
(18) This phenomenon is /studied/investigated/modeled/ using the modified interactions with the original model.
(19) In the following section we give numerical discussion.
(19) In the following section we discuss our numerical investigation.
(19*) In the following section we /present/report/ the results of our numerical investigation.
(20) It would be more interesting to discuss the fully nonlinear case.
(20) It would be more interesting to /study/investigate/treat/consider/

[4] Note also that there is a grammatical problem with this use of "based." In its proper usage, this word can only modify a noun, but here it seems that the intention was for it to modify the verb "discussed." (For detailed discussion regarding the misuse of *based*, see Chapter 25.)

the fully nonlinear case.
(21) There are few discussions using this theory.
(21) There are few /studies/investigations/treatments/ using this theory.
(22) In this section, we discuss the normal coordinates to fourth order.
(22) In this section, we /derive/analyze/treat/ the normal coordinates to fourth order.
(23) By the same discussion on x^{11}, for x^{22}, we obtain the result displayed in Fig. 2.
(23) Applying to x^{22} the /analysis/derivation/computations/ used for x^{11}, we obtain the result displayed in Fig. 2.
(24) It is not easy to discuss dynamical issues in the same way.
(24) It is not easy to /treat/analyze/understand/ dynamical /behavior/phenomena/aspects/characteristics/ in the same way.
(25) In this section, we have discussed that, contrary to the conventional understanding, ρ cannot be a decreasing function of τ.
(25) In this section, we have /argued/shown/demonstrated/proved/ that, contrary to the conventional understanding, ρ cannot be a decreasing function of τ.

50.2 Problem of grammar

There is a second type of problem involving the use of *discuss* that I often encounter. I briefly consider this now.

The following sentences are grammatically incorrect.

(1) We discuss on the relevance of such terms.
(1) We discuss the relevance of such terms.
(2) In the final section we discuss about future directions of investigation.
(2) In the final section we discuss future directions of investigation.

The problem in each of these sentences is that the word that should act as the direct object of "discuss" (i.e. "relevance" and "directions") is preceded by a preposition ("on" and "about"), and as a result, this word incorrectly becomes the object of this preposition instead.[5]

[5]Note that *discuss* is a transitive verb.

Chapter 51

dynamics

There are two common ways in which the noun *dynamics* is misused.

The first misuse of *dynamics* is one of grammar. Although *dynamics* can be used with a singular verb, this is possible only when it is used in an abstract sense or when it is used in reference to a field of study. For example, we have the following.

> (1) Protein dynamics is currently the subject of study in a number of contexts.
> (2) Cloud formation dynamics is poorly understood.
> (3) Dynamics consists of statics and kinetics.

In other cases, a plural verb must be used, as below.

> (4) The dynamics of this map become chaotic at $\alpha = \alpha_0$.
> (5) When this symmetry is broken, the frequencies are no longer commensurate, and the dynamics of the system are no longer simply periodic.
> (6) The dynamics of the airflow around this cylinder become very unstable when v exceeds v_1.

I often find *dynamics* misused with a singular verb in situations like those in (4)–(6).

The second problem involving *dynamics* that I often encounter is exemplified by the following.

> (7) The dynamics (3.1) are structurally unstable.

An equation or map describing the evolution of some quantity should not be referred to as *dynamics*. Rather, these *describe*, *exhibit* or *display* dynamics. Thus (3) is best changed to the following.

> (7) The dynamics /described/exhibited/displayed/ by (3.1) are structurally unstable.

Finally, compare this with the example below.

> (8) We model the dynamics of such flow with the following equation:

Here, "dynamics" refers to physical phenomena.

Chapter 52

each and *every*

There is a problem of ambiguity involving use of the adjectives *each* and *every* in negative assertions.[1] This problem is demonstrated by the following.

(1) Every point is not contained in S.
(1) Not every point is contained in S.
(1*) Some points are not contained in S.
(1**) No points are contained in S.
(2) Each of the functions is not monotonic.
(2) At least one of the functions is not monotonic.
(2*) Neither of the functions is monotonic.
(2**) None of the functions are monotonic.
(3) Every situation is not covered by these conditions.
(3) Not every situation is covered by these conditions.
(3*) Some situations are not covered by these conditions.
(3**) There exist situations that are not covered by these conditions.
(3***) No situation is covered by these conditions.
(4) The wave function for each state is not radially symmetric.
(4) Not all states have radially symmetric wave functions.
(4*) The wave functions for some states are not radially symmetric.
(4**) At least one state has a wave function that is not radially symmetric.
(4***) None of the states have radially symmetric wave functions.

The problems with all of the original sentences here are similar. In the first three sentences, "each" or "every" either acts as the subject or modifies the subject of the main verb, and "not" is an adverb modifying a predicate adjective (which, in (1) and (3) can also be regarded as part of a passive verb form). In (4), grammatically the situation is somewhat different, because "each" modifies "state," which is the object of the preposition "for," while "not" modifies the predicate adjective "radially symmetric." However, in terms of meaning, the situation here is essentially the same as that in (1)–(3), as "the wave function for each state" could be changed to

[1]This problem is similar to those discussed in Section 1 of Chapter 8 and Section 1 of Chapter 12.

something like *each wave function* without altering the meaning significantly. In general, sentences like these are ambiguous.

The problem causing the ambiguity in the above examples is essentially the same as that involving *all* and *both*, discussed in Section 1.1 of Chapter 8. To understand this, let us consider the first example above. Here it is unclear if the sentence is meant to consist of the 'unit ideas' "every point" and "is not contained in S," in which case the state of being "not contained in S" would be seen as applying simultaneously to every point, or if it is meant to consist of the 'unit ideas' "every point is not" and "contained in S," in which case, "not" would be understood as negating "every." The intended meaning in the first case is expressed by (1**), while that in the second is expressed by (1) and (1*). The problems in the remaining examples are similar.

Chapter 53

each other

The pronoun *each other* appears with considerable frequency in the papers I proofread, and in almost all cases it is unnecessary.[1] The following provide examples of verbs and adjectives with which superfluous use of this expression is particularly common.[2]

(1) These values are consistent with each other.
(1) These values are consistent.
(2) These two conditions are incompatible with each other.
(2) These two conditions are incompatible.
(3) These two assertions are contradictory to each other.
(3) These two assertions are contradictory.
(4) a and b coincide with each other.
(4) a and b coincide.
(5) These values agree with each other.
(5) These values agree.
(6) x and y equal each other.
(6) x and y are equal.
(7) In this case, these averages are identical with each other.
(7) In this case, these averages are identical.
(8) S and T are proportional to each other.
(8) S and T are proportional.
(9) These values are opposite of each other.
(9) These values are opposite.
(10) The type of homoclinic orbit for each pair is different from each

[1]The discussion given in this chapter applies equally to the synonymous *one another*, but misuse of this expression is rare.

[2]To understand the problem considered here, it is important to note that there are many cases in which 互いに is appropriate in a given Japanese expression, but *each other* is inappropriate in the corresponding English. For example, in most situations, 互いに矛盾する主張 would perhaps be best translated as *contradictory assertions*, while 彼らは互いに反対の方向へ出かけた would become *They left in opposite directions*. (In many cases, the reason that such expressions as *each other* and *mutually* are not necessary to convey the meaning expressed by 互いに is that this meaning can often be understood from the use of the plural noun form in English. In the above examples, the nouns expressing such a meaning are “assertions” and “directions.”)

other.
(10) The type of homoclinic orbit differs for each pair.
(11) m_{α_1} and m_{α_2} may be different from each other.
(11) m_{α_1} and m_{α_2} may differ.
(12) These are different types from each other.
(12) These are different types.
(12*) These are of different types.
(13) The vectors v_1 and v_2 are orthogonal to each other.
(13) The vectors v_1 and v_2 are orthogonal.
(14) These are dual to each other.
(14) These are dual.
(15) These quantities are complex conjugates of each other.
(15) These quantities are complex conjugates.
(16) These two defects annihilate with each other.
(16) These two defects mutually annihilate.
(17) The proton spins cancel with each other.
(17) The proton spins cancel.
(18) These N effects enhance with each other.
(18) These N effects are mutually enhancing.
(19) These two effects couple to each other.
(19) These two effects couple.
(20) In this case, these particles interact strongly with each other.
(20) In this case, these particles interact strongly.
(21) In this case, T_1 and T_2 are similar triangles each other.
(21) In this case, T_1 and T_2 are similar triangles.
(22) These vectors are parallel to each other.
(22) These vectors are parallel.
(23) The operators ϕ_1 and ϕ_2 are mutually commutable with each other.
(23) The operators ϕ_1 and ϕ_2 commute.
(24) These two sets of results for $\rho(\mu)$ coincide with each other on the whole.
(24) For the most part, the two sets of results for $\rho(\mu)$ are similar.
(24*) For most values of μ, these two sets of results for $\rho(\mu)$ coincide.
(24**) Most of the values in these two sets of results for $\rho(\mu)$ are consistent.
(24***) For most values of μ, the two sets of results are indistinguishable, within the precision of the numerical computation.
(25) These triangles are equivalent to each other.
(25) These triangles are equivalent.
(26) These squares are congruent to each other.
(26) These squares are congruent.

In all of the above examples, the meaning expressed by "each other" is clear without its explicit use. In general, in situations like those illustrated here, this expression should only be used when there is some particular need for emphasis. For example, (19) could be used in the situation that there is some third effect that

has been discussed, and the author wishes to avoid the misinterpretation that the two effects mentioned here couple with the third one. When there is no particular risk of misinterpretation, however, in sentences like the above, *each other* is unnecessary and, indeed, undesirable.

Special attention should be given to (23) and (24), as these sentences demonstrate mistakes involving three other commonly misused words. I occasionally find the word *commutable* used in the manner illustrated by (23). This should be strictly avoided, because this word possesses no mathematical meaning. Also note that "mutually" here is superfluous, because if A commutes with B, it is necessarily the case that B commutes with A. The misuse of "coincide" in (24) makes this sentence very difficult to interpret. Here, "coincide" expresses the meaning that the two functions $\rho(\mu)$ obtained in the two manners in question are *identical*, but this is contradicted by the meaning expressed by "on the whole." The intended meaning of this sentence is quite unclear, but it is probably something like that expressed by one of the rewritten versions.

Chapter 54

entire

The adjective *entire* possesses several closely related meanings, in which it is synonymous with the following: *whole*, *complete*, *total*, *intact*, *of one piece*.[1] The important point to note here is that *entire* is used in the description of the state of a single entity as a whole, not the state of a collection of individual entities. For this reason, *entire* is usually used to modify a singular noun. Also, although it can be used to modify a plural noun, when it does so, it is not used to describe the corresponding collection of objects together but, rather, individually. The following demonstrate its proper use.

(1) This condition holds throughout the entire domain $\mathcal{S}$.
(2) The temperature of the entire system increases instantaneously by δT.
(3) The entire families can be treated in a simpler manner.

In (1) and (2), "entire" could be replaced by *whole*, and in (3), it could be replaced by *complete* or *intact* without changing the overall meaning. It is important to note that the meaning of "entire families" in (3) is **not** *all families*. Here, "entire" does not characterize all the families as a set, and thus this statement is not about the nature of this set itself. Rather, it is about certain individual families belonging to this set. Here, "entire" is synonymous with *complete*, and the meaning of this sentence is that any family that is complete (evidently, any family whose members are all present) can be treated in a "simpler manner."

The following examples typify the misuse of *entire*.[2]

(4) The entire symmetries survive this transformation.
(4) The entire set of symmetries survives this transformation.
(4*) All the symmetries survive this transformation.
(5) The entire particles pass through the membrane during this interval.
(5) All the particles pass through the membrane during this interval.
(5*) Each particle passes through the membrane during this interval.

[1] In fact, it has several other meanings, but these are somewhat obscure and need not be considered.

[2] To avoid the problems considered here, it should be noted that in most situations 全部 cannot be appropriately translated as *entire*.

The meaning of (4) seems to be that each one of those symmetries that is, in itself, "entire" survives. This sentence appears to be describing the situation in which there are some symmetries that possess the property of being "entire" and some that do not, and possessing this property is a sufficient condition for surviving the transformation. However, the actual intention here was not to use "entire" in reference to some property possessed by the symmetries individually but, instead, to express the meaning that the situation described here applies to all the symmetries collectively. This idea is conveyed by the two rewritten versions. (Note that in (4) "entire" modifies "set.") The situation is similar in (5). This sentence seems to imply that some particles have the quality of being "entire" and some do not, and those with this quality pass through the membrane. However, this is not the intended meaning.

Chapter 55

equal

55.1 Problem of meaning

In mathematics, several words are used to express the meaning of 'sameness'. The term *equal* (acting as a verb or adjective) is one example. Often, however, I find this word misused in such a role. In general, *equal* can only be used with regard to quantities. (Here, a 'quantity' is defined as something that can act as the object of an operation.) In mathematics, the following are terms commonly used to express relations of 'sameness' between things that are not quantities: *identical*, *equivalent*, *coincident*, *congruent*, *isomorphic*. In physics, *indistinguishable* can be added to this list.

Before turning to examples, it is worth noting the following point. In mathematics, whether or not a given object is regarded as a quantity depends on the context. For this reason, determining the proper use of *equal* is in general not something that can be done without considering the context of the present study. However, when the nature of this context itself is clear, normally the distinction between quantities and non-quantities too is clear. For this reason, deciding the proper use of *equal* is usually not problematic.

The following demonstrate improper uses of *equal*.

(1) In the case $\mu = 0$, these two theorems are equal.
(1) In the case $\mu = 0$, these two theorems are equivalent.
(2) The actions of these operators are nearly equal.
(2) The actions of these operators are nearly /identical/equivalent/the same/.
(3) The two forms of the solution derived above are in fact equal.
(3) The two forms of the solution derived above are in fact equivalent.
(4) These curves are equal.
(4) These curves are identical.
(4*) These curves coincide.
(5) The two solution spaces are equal in this case.
(5) The two solution spaces are /identical/coincident/ in this case.
(6) It is thus seen that the points p_1 and p_2 are equal.
(6) It is thus seen that the points p_1 and p_2 are /coincident/identical/the

same/.
(7) Then the set of invariants equals the common kernel of these two matrices.
(7) Then the set of invariants is identical to the common kernel of these two matrices.
(8) The calculated point proton distribution is equal to the neutron distribution.
(8) The calculated point proton distribution is identical to the neutron distribution.
(9) In this case the y axis is equal to the y' axis.
(9) In this case the y axis coincides with the y' axis.
(9*) In this case, the y and y' axes coincide.
(10) In the simplest situation, the ϕ dependence of the first vibrational state is equal to that of the third.
(10) In the simplest situation, the ϕ dependence of the first vibrational state is identical to that of the third.
(11) We assume that the true vacuum is equal to the Fock vacuum.
(11) We assume that the true vacuum is /identical to/the same as/ the Fock vacuum.
(12) It is thus proven that Eq. (3.4) is equal to Eq. (4.1).
(12) It is thus proven that Eq. (3.4) is /equivalent/identical/ to Eq. (4.1).
(13) In this paper, we consider the case in which the domain of Σ is greater than or equal to its range.
(13) In this paper, we consider the case in which the range of Σ is a subset of its domain.
(14) In this case, the tangent space $T_{(u,\lambda)}M_0$ equals the null-space $KerD(L_1-F_1)(u,\lambda)$.
(14) In this case, the tangent space $T_{(u,\lambda)}M_0$ /is identical to/coincides with/ the null-space $KerD(L_1 - F_1)(u, \lambda)$.
(15) If we ignore the effect of the small asymmetry, these anomalies are equal.
(15) If we ignore the effect of the small asymmetry, these anomalies are /identical/the same/.
(16) The maps τ^{-1} and η are equal in this case.
(16) The maps τ and η are /equivalent/identical/ in this case.
(17) Triangles abc and $a'b'c'$ are equal.
(17) Triangles abc and $a'b'c'$ /are congruent/are identical/coincide/.
(18) First quantization is equal to the introduction of noncommutativity.
(18) First quantization is equivalent to the introduction of noncommutativity.
(19) It is thus proven that the groups A and B are equal.
(19) It is thus proven that the groups A and B are isomorphic.
(20) To realize the condition $\alpha_L = \alpha_{L'}$, it is not necessary for the lattices L and L' to be equal.
(20) To realize the condition $\alpha_L = \alpha_{L'}$, it is not necessary for the lattices L and L' to be /identical/coincident/.

(21) For linear equations, these methods are obviously equal.
(21) For linear equations, these methods are obviously /equivalent/identical/.
(22) Now let us consider case 1 and case 2 with equal boundary conditions.
(22) Now let us consider case 1 and case 2 with /identical/the same/ boundary conditions.
(23) In the unperturbed case, these surfaces are equal.
(23) In the unperturbed case, these surfaces /coincide/are identical/.
(24) In the simplest case, these branching processes are equal.
(24) In the simplest case, these branching processes are /equivalent/identical/the same/.
(25) Ignoring order relations, the classifications C and $\tilde{C}$ are equal.
(25) Ignoring order relations, the classifications C and $\tilde{C}$ are identical.
(26) In the $\epsilon \to 0$ limit, the tori τ_ϵ and τ_0 become equal.
(26) In the $\epsilon \to 0$ limit, the tori τ_ϵ and τ_0 become identical.
(26*) In the $\epsilon \to 0$ limit, the torus τ_ϵ converges to τ_0.
(27) In most cases of physical interest, these approximations are equal.
(27) In most cases of physical interest, these approximations are /equivalent/identical/the same/.
(28) The domains D and d are equal.
(28) The domains D and d /coincide/are identical/.
(29) Without the last term in (3.1), these expansions are equal.
(29) Without the last term in (3.1), these expansions are /identical/the same/.
(30) Experimentally, however, these effects appear to be equal.
(30) Experimentally, however, these effects appear to be /indistinguishable/of equal magnitude/the same/.
(31) In general, there are two distinct decompositions of U, but in the present case they are equal.
(31) In general, there are two distinct decompositions of U, but in the present case they /are equivalent/are identical/coincide/.
(32) Physically, however, the cases $\xi = 1$ and $\xi = -1$ are equal.
(32*) Physically, however, the cases $\xi = 1$ and $\xi = -1$ are identical.
(32) However, the cases $\xi = 1$ and $\xi = -1$ are experimentally indistinguishable.

55.2 Problem of grammar

There is a second type of mistaken use of the verb *equal* that is quite common. This is seen below.

(1) x equals to y.
(1) x equals y.
(1*) x is equal to y.
(1**) x and y are equal.
(2) A and B equal to C and D, respectively.

(2) A and B are equal to C and D, respectively.
(2*) A and B equal C and D, respectively.

The point to note here is that when *equal(s)* acts as a verb, it is always transitive,[1] and therefore in such cases it cannot be followed by *to*. (Hence, the expression *equals to* is always incorrect, while *equal to* is only possible if "equal" is an adjective.) In (1*) and (2), "equal" is an adjective, modifying "x" and "A and B."

[1] In other words, it takes a direct object.

Chapter 56

especially

The adverb *especially* is overused by Japanese authors. In the works that I proofread, in most instances that this word is used, *in particular*, *particularly* or *specifically* would be more appropriate. Although these expressions are closely related, they are not synonymous.[1]

56.1 Correct use of *especially*, *in particular*, *particularly* and *specifically*

Especially is used in making comparative statements regarding degree. The example below is typical.

> It has been windy all week, but today is especially windy.

Here, "especially" is used to compare today's windiness with that of the previous days of this week and expresses the meaning that its degree is comparatively great (perhaps the greatest).

The expression *in particular*, contrastingly, is usually not used to make statements of degree. Rather, it is used to narrow the focus of discussion to a certain case or example, as in the following.

> Each day this week I go to an interesting city. In particular, tomorrow I go to Bangkok.

In this case, there is no assertion regarding degree, and no comparison is being made. Rather, "in particular" is used to focus the discussion to one specific day.

Particularly can be used either in making comparisons or in narrowing the focus of discussion. However, even when it is used to narrow a focus, to a certain degree it retains a comparative meaning. Thus, while in almost all situations it can replace *especially* without changing the meaning, it cannot replace *in particular* when there is no intended meaning of comparison. For example, it could not be used in place of

[1] The misuse considered here apparently results from the mistaken translation of 特に. It is very important to understand the differences between the situations in which 特に corresponds to the various expressions considered in this chapter.

"in particular" in the above example. In the following, though, both "in particular" and "particularly" are very natural.

> There are several problems with that work. /Particularly/In particular/, its assumptions are unrealistic.

(Note that in this example *especially* could not be used.) While the primary role of "particularly" here is to narrow the focus, there is an implication that the reason that the focus has been narrowed to the "assumptions" is that they are the most problematic part of the paper. With "in particular," this implication is weaker.

Specifically is similar to *in particular*, but, whereas the latter is used to narrow the focus of discussion, the former is used to make it more concrete.

Although *especially* and *in particular* are both adverbs, they generally play different grammatical roles, with *especially* modifying adjectives and *in particular* modifying verbs. For example, in the above examples, "especially" modifies "windy," while "in particular" modifies "go" and "are." *Particularly* can be used quite naturally to modify either an adjective or a verb. In the former role, it is usually close in meaning to *especially*, while in the latter, it is usually similar to *in particular*. *Specifically*, like *in particular*, is generally used to modify verbs.

56.2 Misuse of *especially*

In the papers I have proofread, the misuse of *in particular*, *particularly* and *specifically* is quite rare, but the misuse of *especially* is very common. Consider the typical examples below.

> (1) This solution is stable with respect to any small perturbation with bounded support. Especially, it is stable with respect to the class of perturbation described above.
> (1) ...In particular, it is stable with respect to the class of perturbations described above.
> (2) It is not difficult to show that each ψ_i is an eigenfunction of $\mathcal{T}$ and that its eigenvalue e_i satisfies $0 < e_i \leq \mathcal{E}$. Especially, for the s-symmetric solution, ψ_1, we have $e_1 = \mathcal{E}/2\pi$.
> (2) .../In particular/Specifically/ for the s-symmetric solution, ψ_1, we have $e_1 = \mathcal{E}/2\pi$.
> (3) In the following sections we present results for our experiments on each of these four types of systems. Especially, in Section V, we give detailed results which we believe provide conclusive support of the predictions of Young and Thomas.
> (3) .../In particular/Particularly/, in Section V, we give detailed results which we believe provide conclusive support of the predictions of Young and Thomas.
> (4) In this paper we study front propagation phenomena described by reaction-diffusion equations. Especially, we consider the class of semilinear parabolic equations and the behavior described by these.

(4) /In particular/Particularly/Specifically/, we consider the class of semi-linear parabolic equations and the behavior described by these.

The assertion of (1) is that somehow the solution in question is more stable with respect to the "class of perturbations described above" than with respect to other small perturbations with bounded support. The intended meaning – that this assertion regarding stability holds specifically (but not with any greater degree) for "the class of perturbations described above" – is expressed by the corrected version. Here, *particularly* is not appropriate because it would impart a meaning similar to that of "especially." *Specifically* could be used, but in that case, it would be possible to interpret this sentence as implying that the "class of perturbations described above" constitutes the class of all small perturbations with compact support. If this were indeed the intention, however, a different wording of this sentence would be more appropriate.

Example (2) simply makes no sense. Here, too, *particularly* would be somewhat inappropriate.

From (3), the reader would conclude that some results supporting the predictions of Young and Thomas are given in other sections, but most of them are given in "Section V." Note that *specifically* is not appropriate in this case, because the nature of the discussion has not become more concrete.

The meaning of (4) is that "we" are interested more in the particular sub-class of reaction-diffusion equations mentioned here than in other reaction-diffusion equations. It seems to imply that although this paper does treat other types of reaction-diffusion equations, for the most part it studies this sub-class. Of course, this is possible, but if this were the intended meaning, something like the following would be more appropriate.

(4*) ...While we give a brief discussion that applies to this general class of equations, we mainly consider the sub-class of semi-linear parabolic equations and the behavior described by these.

(4**) ...While we briefly study equations of a more general type, we mainly consider the sub-class of semi-linear parabolic equations and the behavior described by these.

By contrast, (4) implies that the present paper treats only the sub-class of semi-linear parabolic equations.

The two sentences below demonstrate correct uses of *especially*.

(5) In the $T > T_c$ regime this turbulent behavior becomes much more pronounced, and this is especially true near the boundaries.

(6) There are three significant sources of this error. Especially large among these is that resulting from the discontinuity of B.

Here, the implication of degree expressed by "especially" is appropriate.

Chapter 57

except for and synonymous expressions

The preposition *except for* and synonymous expressions[1] are misused in a number of ways.[2] Here I examine the most common of these. Because most actual occurrences of the misuse I treat in this chapter involve *except for*, all of the discussion is given in terms of this expression. However, it should be kept in mind that in this discussion *except for* acts as a representative of this class of expressions.

57.1 Correct use

Before studying misuses of *except for*, I briefly discuss two proper uses.[3] Some types of misuse considered in this chapter are best understood as mistaken applications of the two proper usages discussed below.

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[1]These include *apart from*, *bar*, *barring*, *but*, *except*, *excepting*, *excluding*, *not including*, *save*, *save for*, *with the exception of* and *with the exclusion of*.

[2]The mistaken uses demonstrated in this chapter seem to result from the direct translation of such expressions as ... 以外に, ... を除いて and ... を別にすれば as *except for...* It should be noted that, although sometimes such a translation is possible, usually it is not.

[3]There is one other way in which *except for* can be used. This is demonstrated by the following.

> This would be an easy problem, except for the complication involving the limit.
> Except for a hail storm, we could have completed the work.

In this usage, *except for* expresses the meaning of *if not for*. Usually it is used in this way with either of the auxiliary verbs *could* or *would*, expressing a contrary to fact meaning. In such situations, the prepositional phrase introduced by *except for* is an adverbial, modifying a verb. Note that the role of *except for* in this usage is much different from that in (1)–(3). In (1)–(3), "except for" introduces exceptions that do not change the overall situation significantly, whereas in the present case, it introduces the factor controlling the situation, which, in general, is responsible for *preventing* something. For example, the connotation of the first sentence above is that the problem in question is not easy, while that of the second sentence is that the work was not completed. Although it is important to note that *except for* has this additional usage, I do not consider it further here.

57.1.1 First meaning

The most common use of *except for* is demonstrated by the following.[4]

(1) All of these terms, except for the last one, are linear in x.

Here, “except for” is synonymous with the expression *with the exception of.* The meaning of a prepositional phrase of the form *except for + [object]* is that *[object]* represents an exception. In the above example, this object is “the last one.” Thus, the meaning of this sentence is that the last term is an exception to the main assertion that all the terms are linear in x. When used with this meaning, *except for* introduces a prepositional phrase that can only modify either a noun or an adjective. In the above, it modifies the pronoun “all,” which refers to the entire set of “terms.” This sentence demonstrates the most common logical structure involved with the expression *except for*:

[class of entities characterized by some common property] + , except for + [exceptional member(s) of the class not so characterized] + , + [common property][5]

The important point here is that *[exceptional...]*, which is the object of the preposition “except for,” is a member of the class of entities in question.

57.1.2 Second meaning

The following demonstrate another usage.[6]

(2) The proof of (5.22) is the same as that of (3.10), except for obvious modifications.
(3) The difference $\mu - \nu_\alpha$ is fixed, except for small thermal fluctuations around the mean value.

In these sentences, the prepositional phrases introduced by “except for” modify the adjectives “the same” and “fixed.” Here, as in (1), the meaning of *except for* is *with the exception of*, but in these cases, the logical structure is different. In the present case, this structure is the following:

[statement of a general situation] + , except for + [something whose existence is inconsistent with the general situation][7]

In (2), the general situation is the sameness of the proofs, while that which is inconsistent with this sameness is the necessity of modifications. In (3), the general situation is the constancy of $\mu - \nu_\alpha$, and the existence of the fluctuations is inconsistent with this.

[4]Of the synonyms of *except for* listed in the first footnote of this chapter, all but *save for* can be used in this manner.

[5]The construction *[class of entities characterized by some common property] + [common property] + , except for + [exceptional member(s) of the class not so characterized]* is also possible (e.g., *All s_i are even, except for s_0.*). In particular, this construction can be better when the sentence is short. However, for clarity, the construction given above is usually preferable.

[6]Of the synonyms of *except for* listed in the first footnote, all but *bar*, *barring*, *but*, *except* and *save* can be used in this manner.

[7]The reversed structure, *except for + [something whose existence is inconsistent with the general situation] + , + [statement of the general situation]* is also possible, but less common.

57.2 Incorrect use

57.2.1 Misused in place of *except at*, *except in*, etc.

Mistaken first meaning usage

The most common misuse of *except for* is illustrated by the examples appearing below. In each of these sentences, this expression is used with the first meaning cited in the previous section.

> (1) This procedure gives the counterterms for $\mathcal{B}_j$, except for the points $y = x_i$, where $\{\mathcal{E}_j\}$ is the null set.
> (1) This procedure gives the counterterms for $\mathcal{B}_j$, except at the points $y = x_i$, where $\{\mathcal{E}_j\}$ is the null set.
> (2) These conditions cannot be satisfied, except for those systems for which $J(E, a)$ has a special functional property.
> (2) These conditions cannot be satisfied, except /in/by/ those systems for which $J(E, a)$ has a special functional property.
> (3) Except for the large $\tan\beta$ case, ϵ is determined as follows.
> (3) Except in the large $\tan\beta$ case, ϵ is determined as follows.
> (4) Except for countable discontinuous points, all generated maps have the gradient given in (2).
> (4) Except at countable discontinuous points, all generated maps have the gradient given in (2).
> (5) This relaxation is characterized by exponential decay, except for the phase transition point.
> (5) This relaxation is characterized by exponential decay, except at the phase transition point.
> (6) No exact solution has been found except for the one-dimensional case.
> (6) No exact solution has been found, except in the one-dimensional case.
> (7) In this paper we exclusively consider Hamiltonian systems, except for the final two subsections.
> (7) In this paper we exclusively consider Hamiltonian systems, except in the final two subsections.
> (8) $\mathcal{A}'$ and $\mathcal{N}'$ are defined similarly to $\mathcal{A}$ and $\mathcal{N}$, except for $\lambda_k = 0$.
> (8) $\mathcal{A}'$ and $\mathcal{N}'$ are defined similarly to $\mathcal{A}$ and $\mathcal{N}$, except in the case $\lambda_k = 0$.
> (9) This model displays the conformal anomaly except for $D = 26$, where D denotes the number of the scalar fields.
> (9) This model displays the conformal anomaly, except /in the case/when/ $D = 26$, where D denotes the number of scalar fields.

The first point to realize regarding the misuse we study here is that there are many expressions of the the form *except + [preposition]*, and they all have different meanings. Therefore one must be careful when using such an expression that it conveys the intended meaning. The meaning of *except for* in the usage considered presently is that the object of the prepositional phrase it introduces represents an exception. For example, in (1), the meaning expressed by "except for" is that these

"points" are exceptions of some kind, and interpreting this sentence literally, its implication is that these "points" are exceptional "counterterms." However, this cannot be the author's intention. Obviously, the intended meaning is not that the points are exceptional counterterms but, rather, that at these points the system exhibits exceptional behavior. (Specifically, it is exceptional because at these points, "these procedures" do not give the counterterms in question.) This meaning is expressed by (1). Note that we could use *except for* here if we rewrote this sentence something like the following.

> (1*) This procedure gives the counterterms for $\mathcal{B}_j$ at all points, except for those points $y = x_i$ where $\{\mathcal{E}_j\}$ is non-zero.

Written this way, the prepositional phrase "except for..." modifies "all points," and thus the implication is that the points at which $\{\mathcal{E}_j\}$ is non-zero are exceptional points.

A literal interpretation of (2) leads one to believe that "systems" refers to some kind of conditions or systems of conditions. Obviously, the intended meaning is quite different.

In (3)–(7) as well, "for" in "except for" of the original must be changed to some other preposition. For (8) and (9), somewhat different changes are needed.

To further clarify the problem here, it is useful to give some discussion of grammar. In each of the original sentences above, the source of the problem can be regarded as a grammatical mistake. In each case, the intention was to use the prepositional phrase "except for..." to modify a verb. However, as discussed in the previous section, when used with the meaning of *with the exception of...*, as in each case here, such an expression can only modify a noun or an adjective. Thus, interpreting the above original sentences according to strict rules of grammar, these prepositional phrases seem to modify the following: (1) "counterterms"; (2) "conditions"; (3) "ϵ"; (4) "all"; (5) "relaxation"; (6) "solution"; (7) "paper"; (8) "$\mathcal{A}$ and $\mathcal{N}$"; (9) "model" or "anomaly." The resulting connotations of these sentences are therefore that the exception in question is a type of counterterm, a type of condition,... In contrast to *except for...*, prepositional phrases introduced by *except in...*, *except at...* and *except by...* (see corrected versions) can be used to modify verbs.

Mistaken second meaning usage

Consider the following.

> (10) The processes $\{T_1, a_1; T_2, a_2\}$ of the small systems are reversible, except for special cases.
> (10) The processes $\{T_1, a_1; T_2, a_2\}$ of the small systems are reversible, except in special cases.
> (11) The two potentials U_1 and U_3 are identical, except for the intermediate range around $E/E_c = 1$.
> (11) The two potentials U_1 and U_3 are identical, except in the intermediate range around $E/E_c = 1$.
> (12) None of these values exceeds the threshold, except for very rare

fluctuations.
(12) None of these values exceeds the threshold, except in the case of rare fluctuations.
(12*) These values exceed the threshold only in the case of rare fluctuations.
(13) We thus find that $s(k) = t(k)/2$, except for $k = 0$.
(13) We thus find that $s(k) = t(k)/2$, except at $k = 0$.
(14) This argument holds, except for when there are divergent terms.
(14) This argument holds except when there are divergent terms.
(14*) This argument holds /if/when/ there are no divergent terms.
(15) The eigenvalues α_1^{2n-1} and β_1^{2n-1} are equal, except for α_1^1 and β_1^1.
(15) The eigenvalues α_1^{2n-1} and β_1^{2n-1} are equal, except in the case $n = 1$.
(16) Except for the region of the Cauchy horizon, the perturbations are finite and small.
(16) Except in the region of the Cauchy horizon, the perturbations are finite and small.
(17) We can see that the energy dependence of the factor F_0 is not large, except for the $s_{1/2}$ neutron hole state.
(17) We can see that the energy dependence of the factor F_0 is not large, except in the case of the $s_{1/2}$ neutron hole state.

In the original sentences here, it seems that the authors have attempted to use "except for" as in the second case discussed in the previous section. In each of these sentences, however, there is a problem. To see this, let us recall the logical structure demonstrated by (2) and (3) in Section 1. As discussed there, in this type of usage, the object of *except for* represents something whose existence is inconsistent with the general situation described in the main part of the sentence. In (10), this general situation is the reversibility of the processes under consideration. Thus, the only type of expression that could correctly act as the object of "except for" is one representing some irreversible behavior – either irreversible behavior of individual processes or irreversible processes themselves. Clearly, "special cases" is not of this type. This expression refers to *cases* in which the processes under investigation are not reversible. Thus, logically, the implication of this sentence is that *cases* in which the processes are not reversible themselves constitute irreversible *behavior*. Obviously, this is nonsense. We could make this sentence meaningful by changing the direct object to something representing irreversible behavior. For example, this sentence would be quite natural if "special cases" were changed to *a small stochastic contribution whose ensemble average for a complete cycle vanishes*. The meaning of the sentence would then be that this small contribution constituting irreversible behavior is not important and that, as an approximation, the system can be considered reversible. This, however, is not the intended meaning of the original. The intended meaning is that the "special cases" in which the processes are not reversible are exceptional cases. This meaning is expressed by (10).

The implication of (11) is that the *existence* of the intermediate range itself is inconsistent with the identity of the two potentials in question. Obviously, however, it is the *behavior* of the potentials in this range that is inconsistent with this identity.

The problem with (12) is that it is not the existence of these fluctuations themselves that is inconsistent with the condition stated in the main clause but, rather, the existence of cases in which there are such fluctuations. This is a somewhat subtle point. (Another problem with this sentence is that "except for" could be interpreted with the first meaning discussed above. Such an interpretation, however, would yield the very strange meaning that "fluctuations" are a type of "value.")

The implication of (13) is that the existence of the value $k = 0$ itself is inconsistent with the equality of $s(k)$ and $t(k)/2$. In fact, however, that which is inconsistent with the equality of these two functions is their inequality at $k = 0$. Thus if we were to rewrite this using *except for* properly, it would become something like the following: *We thus find that* $s(k) = t(k)/2$, *except for the anomalous discrepancy between these functions at* $k = 0$.

Example (14) simply demonstrates a superfluous use of "for."

The problem in (15) is similar to that in (13). This sentence asserts that the existence of α_1^1 and β_1^1 is inconsistent with the equality of α_1^{2n-1} and β_1^{2n-1}. In fact, however, it is not the existence of these values but their inequality that is inconsistent with the relation $\alpha_1^{2n-1} = \beta_1^{2n-1}$.

Finally, note that (16) is very similar to (11), and (17) is very similar to (10).

57.2.2 Incorrect object

As seen in the above examples, prepositional phrases of the form *except for...* are sometimes used to modify nouns. In such a situation, the object of the prepositional phrase represents an exception to the general case regarding the noun that the prepositional phrase modifies. For this reason, these two nouns must denote things of the same type. The following sentences demonstrate misuse in which this is not the case.

> (18) The accuracy of such predictions has not been fully analyzed except for axisymmetric configurations.
> (18) The accuracy of such predictions has not been fully analyzed, except in the case with axisymmetric configurations.
> (19) This result accounts for all cases, except for positive Λ.
> (19) This result accounts for all cases, except for those with positive Λ.
> (20) The functions $f_q(x)$ all have this general form, except for very small q^2/S.
> (20) The functions $f_q(x)$ all have this general form, except for those with small q^2/S.
> (20*) The functions $f_q(x)$ all have this general form, except in the case of small q^2/S.
> (21) All the signs except for U_1^3 can be determined immediately from this formula.
> (21) All the signs except for that of U_1^3 can be determined immediately from this formula.
> (22) Among these, 49 states except for $\Delta\, D_{35}(1930)$ are classified as type 1.
> (22) Among these, 49 states, not including $\Delta\, D_{35}(1930)$, are classified as

type 1.
(22*) Among these, 49 states, including $\Delta\, D_{35}(1930)$, are classified as type 1.
(23) All these baryonic states are plotted in Fig. 1 except for the Ξ sector, where there are only two states.
(23) All these baryonic states, except those in the Ξ sector (which contains only two states) are plotted in Fig. 1.

The implication of (18) is that "axisymmetric configurations" are a type of "accuracy." Example (19) erroneously relates the idea that "positive Λ" is a "case." (The distinction here may seem subtle.) Example (20) suggests that "small q^2/S" is one of the "functions $f_q(x)$." According to (21), "U_1^3" is a sign. The meaning of (22) is quite unclear. It could be interpreted as describing either the case that $\Delta\, D_{35}(1930)$ is included in these 49 states or the case that it is not. A strict interpretation would lead us to conclude that it is included. However, it seems that the intended meaning is the opposite. The connotation of (23) is that the Ξ sector is a state.

57.2.3 Other problems

The following illustrate various other problems I encounter with the use of *except for*.

(24) This approach does not require any extra physical modes except for the usual one.
(24) This approach does not require any physical modes other than the usual one.
(24*) This approach requires only the usual extra physical mode.
(25) No other assumption except for the choice of the non-trivial initial functions is required.
(25) No assumption other than that regarding the choice of the non-trivial initial functions is required.

The meaning intended by the author of (24) is that expressed by (24). Clearly, the original does not convey this meaning, as it implies that the "usual" physical mode is itself "extra." Also note that even if the intention were to make such an assertion, the original here is a very awkward way of doing so. In this case, (24*) would perhaps be the best choice. In (25) "except for" is redundant, because it expresses essentially the same meaning as "no other." Also note here that there is a mismatch of nouns, as this sentence asserts that this "choice" is an "assumption."

Chapter 58

feature

The noun *feature* should not be used in place of such words as *behavior*, *nature* and *form*. For example, consider the following.

> (1) For $\alpha < \alpha_1$, the system exists in a homogeneous state. When α exceeds α_1, this state first becomes metastable and later unstable with respect to the mode u_0. Further increasing α, a succession of higher and lower wavelength modes appear in the equilibrium state, and its pattern becomes more and more complex. This feature has been observed in experimental studies of many types of physical systems.
> (2) The discrete feature of this model has a number of implications.
> (3) The irreversibility we observe in macroscopic physical systems seems to belie the reversible feature of the theories that describe their (apparently) underlying microscopic dynamics.
> (4) The sinusoidal feature of this solution is significant.
> (5) We feel that this interpretation correctly represents the underlying feature of this general method.
> (6) It is thus found that the features of the basin of attraction depend on the method of activity control.
> (7) Figure 1 illustrates the generic feature of the potential.
> (8) The feature that the calculated gaps are very similar to those obtained in the non-relativistic calculations also supports this conclusion.
> (9) Here we observe an interesting feature in response to the invasion of type B cells: the emergence of chaotic fluctuations.
> (10) Granular materials exhibit several features that distinguish them from fluids.

In these sentences, "feature(s)" should be replaced by *behavior* in (1), *nature* in (2) and (3), *form* or *behavior* in (4), *essence*, *mathematical structure* or *principles* in (5), *nature* or *characteristics* in (6), *form* or *functional dependence* in (7), *fact* in (8), and *behavior*, *reaction*, *development*, *change*, or something similar, in (9). In (10), either "feature" should be replaced by *types of behavior*, or "exhibit several features" should be replaced by *possess several properties*.

It should be kept in mind that *feature*, like *characteristic*, *quality* and *aspect*, is only used in reference to things that are countable and distinct. Also, while an

entity or phenomenon may have just a single nature or essence, in general it will have many features.

The following illustrate typical proper uses of *feature*.

> (11) The characteristic features of this class of distributions are the existence of a primary peak near $\tau = 1$, the existence of a secondary peak on the positive side of the primary peak, and a monotonically decreasing form for $\alpha > 2\pi$.
> (12) The most important feature of this solution is its symmetry.

Chapter 59

for a moment vs. *for the moment*

The phrases *for a moment* and *for the moment* are not synonymous. The former is usually used to express the meaning that the time during which some event takes place, some act is carried out, or some state exists is short. In most situations it can be translated as 一瞬. The latter, by contrast, is usually used to express the idea that the existence, state, status, role, treatment, interpretation, etc., of something is temporary or preliminary. It can usually be translated as 取り敢えず. These differences in meaning can be understood by considering the difference between the articles *a* and *the*. With the indefinite article *a*, the implication is that the moment in question is not specific. In this case, *moment* simply means *short time*. Thus, *for a moment* is exactly synonymous with *for a short time*. With the definite article *the*, however, the implication is that reference is being made to some specific moment, namely, the present one. Hence, *for the moment* means *for the present time*.[1]

The following demonstrate correct uses of these two expressions.

> (1) For the moment we ignore the effect of the small perturbation term in this equation.

The implication here is that as a first step in our treatment of the equation in question, we ignore the perturbation. Note that if we changed "for the moment" to *for a moment*, the resulting meaning would be very unnatural. In this case, it would seem as if we simply ignore the perturbation for a short time, although this does not necessarily have any connection with how we treat the equation. Now, compare (1) with the following.

> (2) When the forces cancel, for a moment the surface takes the form of a sphere, and then it begins to collapse in an asymmetric manner.

Here, the meaning of *for a short time* expressed by "for a moment" is appropriate. Clearly, *for the moment* is not possible in this case.

[1] The following are also synonyms of *for the moment*: *for the time being*, *for now*, *for the present*.

Chapter 60

from now and *from now on*

In the works that I proofread, the phrases *from now* and *from now on* present several problems. In many situations that I encounter these expressions, they are entirely superfluous, and in most others, there are more precise expressions that can be used. In addition, in general, their use is stylistically poor because they are too informal for scholarly written work.[1] The following present better alternatives.

(1) From now on we assume this value vanishes.
(1) /From this point/Henceforth/ we assume this value vanishes.
(1*) We now assume that this value vanishes.
(2) From now on let X be an Alexandrov surface of curvature bounded below without boundary.
(2) For the remainder of the paper, we consider X to be an Alexandrov surface of curvature bounded from below.
(3) From now on, we call this type of ordered structure 'layered'.
(3) We refer to this type of ordered structure as 'layered'.
(4) From now on we investigate the non-linear case.
(4) In the remainder of /the paper/this section/ we investigate the non-linear case.
(5) For convenience, we omit the subscript on each of these variables from now.
(5) For convenience, we omit the subscript on each of these variables from this point.
(6) Here $\mathcal{F}_i$ is a function of ϕ that we call the "ith total difference function" from now on.
(6) Here $\mathcal{F}_i$ is a function of ϕ that we call the "ith total difference function."
(7) From now on, let ψ_c denote the function corresponding to the minimum of the functional $\Omega[\psi]$.
(7) Let ψ_c denote the function corresponding to the minimum of the functional $\Omega[\psi]$.
(8) From now on we set $\nu = 0$.

[1] As the examples presented here show, in scholarly papers, the meanings of such expressions as これから and 以下で should not be expressed by *from now* or *from now on*.

(8) We now set $\nu = 0$.
(9) From now on, we write $G_R(y^{(i)} - \tilde{y}^{(i)})$ as G^i.
(9) /In the remainder of the paper/Henceforth/, we write $G_R(y^{(i)} - \tilde{y}^{(i)})$ as G^i.
(10) To simplify the results, from now on, we choose $\omega \leq 0$.
(10) To simplify the results, we choose $\omega \leq 0$.
(11) All of our considerations from now on will apply to the behavior after the collision.
(11) In the remainder of the paper, we consider only the behavior after the collision.
(12) From now on, a_i $(i = 1, 2, \cdots)$ are arbitrary constants.
(12) From this point we consider a_i $(i = 1, 2, \cdots)$ to be arbitrary constants.

One of the reasons that *from now on* and *from now* are often stylistically poor can be understood from the above examples. In general, these expressions carry a time-like meaning. When such a meaning is inappropriate, as in the situations considered here, the result is a mismatch of meaning that leads to an informal air.

Chapter 61

hard and *hardly*

The adjective *hard* and its adverbial form *hardly* are among the words most commonly misused by Japanese scholars. There are several usages of these words that should be avoided. Here I give representative examples.

61.1 *hardly* misused to mean *rarely*

The adverb *hardly* should never be used to mean *rarely*. It simply does not possess such a meaning.[1] The following are typical of this type of mistaken usage.

(1) This case hardly is realized.
(1) This case is rare.
(1*) This case is only rarely realized.
(2) Evolution leading to the bifurcation of the attractor part is hard to occur.
(2) Evolution leading to the bifurcation of the attractor part rarely occurs.
(3) These higher states are hardly observed in normal one-photon excitation spectroscopy.
(3) These higher states are only rarely observed in normal one-photon excitation spectroscopy.
(3*) These higher states are difficult to observe in normal one-photon excitation spectroscopy.

61.2 *hardly* misused to mean *slightly*

Although one of the meanings of the adverb *hardly* is that of *slightly* or *only slightly*, this usage should be avoided in scholarly writing, as it is quite colloquial. In the following I present some alternatives.

[1] The problem considered in this section seems to result from the translation of めったに... ない or ほとんど ... ない as *hardly...* In fact, めったに... ない and ほとんど ... ない (when used as a synonym of めったに... ない) correspond not to *hardly...* but to *hardly ever...*, which indeed is synonymous with *rarely*. However, *hardly ever* should also be avoided, because it is too informal for use in written work.

(1) This behavior is hardly changed under the mapping.
(1) This behavior is changed only slightly under the mapping.
(2) This parameter hardly changes when the strength of the magnetic field is changed.
(2) The value of this parameter changes only very little when the magnetic field strength is changed.
(2*) This parameter is only weakly dependent on the strength of the magnetic field.
(2**) The value of this parameter is largely insensitive to the strength of the magnetic field.
(3) The Lyapunov exponents hardly depend on the value of a in this range.
(3) The Lyapunov exponents depend only weakly on the value of a in this range.
(3*) The Lyapunov exponents have only a weak dependence on the value of a in this range.
(3**) The Lyapunov exponents are nearly independent of the value of a in this range.
(4) Such an effect does exist in the present case, but it hardly changes the following argument.
(4) Such an effect does exist in the present case, but this fact is insignificant with regard to the following argument.
(4*) Such an effect does exist in the present case, but this is /unimportant/of little significance/ in the following argument.

61.3 *hard* misused to mean *difficult*

It is best to avoid *hard* when the intended meaning is expressed by *difficult*. These words can be used synonymously, but, as demonstrated by the following examples, *hard* is somewhat too informal for scholarly writing in this usage. Also, because its meaning is broader than that of *difficult*, sometimes use of *hard* can result in ambiguity.

(1) This is a very sensitive system, and it is hard to obtain consistent results with the primitive method we employed.
(1) This is a very sensitive system, and it is difficult to obtain consistent results with the primitive method we employed.
(2) This explanation is hard to understand.
(2) This explanation is difficult to understand.
(3) It seems hard to understand how this theory can capture the behavior of an actual system.
(3) It is difficult to imagine how this theory can capture the behavior of an actual system.
(4) It is hard to find regions where $g < -\pi/N - 1$, $g > \pi$.
(4) It is difficult to find regions in which both $g < -\pi/N - 1$ and $g > \pi$ are satisfied.

(4*) It is difficult to find regions satisfying both $g < -\pi/N - 1$ and $g > \pi$.
(4**) It is difficult to find regions characterized by the inequalities $g < -\pi/N - 1$ and $g > \pi$.
(5) Of course, this is a hard problem that cannot be answered in a single paper.
(5) Of course, this is a difficult problem that cannot be solved in a single paper.
(6) We can hardly measure the decay time of individual biological neurons.
(6) It is difficult to measure the decay time of individual biological neurons.
(7) The symmetric state seems to be hardly destroyed in this case.
(7) It seems that the symmetric state is /difficult to destroy/not easily destroyed/ in this case.
(7*) The symmetric state is not destroyed in this case.

As demonstrated by (6) and (7), sometimes *hardly* is also misused in place of *difficult*. This problem is much more serious than that illustrated by (1)–(5). Of the above original sentences, (7) is most difficult to interpret. The two most plausible interpretations are given in (7) and (7*), but there seem to be other possibilities.

61.4 *hardly* misused to express a simple negative meaning

Hardly should never be used to express a simple negative meaning, as demonstrated by the following.

(1*) The simple BCS wave function hardly describes the ground state in this range of parameter values.
(1) The simple BCS wave function /does not/does not satisfactorily/ describe the ground state in this range of parameter values.

It may appear that the intended meaning of "hardly" here is something like *barely*. However, this possibility must be dismissed, as the expression *barely describe* in this situation is meaningless from the scientific point of view.

61.5 More serious problems

The following sentences illustrate a problem involving the use of *hard* that is similar, both in terms of grammar and meaning, to that discussed in Section 1 of Chapter 48 with regard to *difficult*. Detailed elucidation of this problem is given there.

(1) This very direct method is hard to produce results without considerable calculational effort.
(1) Using this very direct method, it is very difficult to produce results without considerable calculational effort.

(2) This approach seems hard to produce the desired results.
(2) It seems difficult to produce the desired results using this method.
(2*) It seems that this approach could only produce the desired results /with a great deal of effort/under somewhat artificial conditions/with a very special set of initial conditions/...
(3) It is hard for this model to have significant long-range interactions.
(3) It is difficult to realize significant long-range interactions in this model.
(3*) Significant long-range interactions are not easily realized in this model.
(4) The correlations among these parameters are hard to be seen.
(4) The correlations among these parameters are /hard to see/difficult to discern/.
(4*) The correlations among these parameters are difficult to /extract/compute/obtain/derive/.
(5) It is hard for the present model to describe pacemaker oscillation in this regime.
(5) It is difficult to describe pacemaker oscillation in this regime /with/using/ the present model.

Chapter 62

have to and *must*

The auxiliary verbs *have to* and *must* should not be used with *only* in situations like the following.

(1) We /have to/must/ change only two parameters.
(1) Only two parameters need to be changed.
(1*) We need only change two parameters.
(1**) We are allowed to change only two parameters.

The original sentence above is ambiguous. It could be interpreted as meaning that changing fewer than two parameters is not allowed but changing more is allowed (as expressed by (1) and (1*)) or that changing more than two parameters is not allowed but changing fewer is allowed (as expressed by (1**)). The problem here results from the fact that we can think of the meaning of necessity expressed by "/have to/must/" as applying in two different ways. Specifically, we could regard "/have to/must/ change" as a unit that applies to the unit "only two parameters," which leads to the first interpretation above, or we could regard "/have to/must/" as a unit that applies to the unit "change only two parameters," which leads to the second interpretation.[1]

In the above example, "only" acts as an adverb, modifying the adjective "two," which modifies the direct object "parameters." There are other grammatical situations in which the use of *have to* or *must* with *only* results in ambiguity. For example, consider the following.

(2) Two parameters only /have to/must/ change.
(2) Only two parameters need be changed.
(2*) Only two parameters are allowed to change.
(3) We /have to/must/ only change two parameters.
(3) We need only change two parameters.
(3*) We are allowed only to change two parameters.
(3**) We need to change only two parameters.
(3***) We are allowed to change only two parameters.

[1]In spoken English, the intended meaning of (1) can be made clear by applying the appropriate stress.

In (2), (2) and (2*), "only" is an adverb modifying the adjective "two," which modifies the subject "parameters."[2] In (3), (3) and (3*), "only" is an adverb, modifying the verb "change."

[2]Actually, in (2), "only" could also be interpreted as an adjective modifying the subject "parameters." In this case, the implication of the sentence would be that it is just the parameters (i.e. not operators, functions...) that must be changed.

Chapter 63

have to do with

Use of the verb-preposition combination[1] *have to do with* with the meaning of *have a relation to* or *have a connection with* should be avoided in scientific writing. This expression is usually used with regard to human interaction, and for this reason, when used in other contexts it sounds quite informal. In addition, and more importantly, generally there are more precise expressions that can be used in its place. I give examples of such alternative expressions below.

(1) This problem only has to do with the spin degrees of freedom.
(1) This problem only involves the spin degrees of freedom.
(2) At this point it is unclear what the operator τ has to do with time reversal.
(2) At this point the relation between the operator τ and time reversal is unclear.
(3) This effect has to do with the finite nature of N.
(3) This effect /results from/is due to/is related to/ the finite nature of N.
(4) The manner in which these defects disappear has to do with the symmetry of the system.
(4) The manner in which these defects disappear /depends on/is determined by/is related to/ the symmetry of the system.
(5) We use this cutoff in the gauge coupling because it has nothing to do with gauge fields.
(5) We use this cutoff in the gauge coupling because it /has no relation to/is completely independent of/ the gauge fields.
(6) These problems only have to do with the formulation of the theory in an infinite space.
(6) These problems /exist/arise/ only in the formulation of the theory in an infinite space.
(7) However, in this case, the stiffening transition has nothing to do with the roughening transition.
(7) However, in this case, the stiffening transition /is unrelated to/is independent of/ the roughening transition.

[1] Such a combination is called a 'prepositional verb'.

As illustrated by the above examples, use of *have to do with* often results in very awkward sentences. This is a third reason why this expression should be avoided.

Chapter 64

hint

The word *hint* (both as a noun and a verb) should be avoided in scholarly writing. Usually this word is too imprecise and too informal for written work. In almost all cases that I find *hint* used, there are better alternatives. Here I give several typical examples.[1]

> (1) We hope this line of argument gives us a hint to deduce meaningful results from the matrix models.
> (1) We hope this line of argument is /helpful/useful/advantageous/ in deducing meaningful results from the matrix models.
> (1*) We hope this line of argument is /helpful/useful/advantageous/effective/ for deducing meaningful results from the matrix models.
> (2) Further study of the intermittency in this system will give more insights and hints for understanding the multi-scaling properties observed in complex dissipative systems.
> (2) Further study of the intermittency in this system should provide insight and lead to a deeper understanding of the multi-scaling properties observed in complex dissipative systems.
> (3) We believe that the lower-dimensional theories will provide hints as to the quantization of four-dimensional general relativity.
> (3) We believe that the lower-dimensional theories will provide information that /will help/be useful/ in determining a method to quantize four-dimensional general relativity.
> (4) These experimental data provide some hints for relations between the KM matrix and the quark mass ratios.
> (4) These experimental data provide information that helps to determine the relations between the KM matrix and the quark mass ratios.
> (5) These parameters should offer us hints beyond the Standard Model.
> (5) These parameter values should be useful in an attempt to construct a theory beyond the Standard Model.
> (6) It is important to obtain accurate parameter values in order to obtain

[1] One point to note here is that there are situations in which the Japanese ヒント does not correspond to the English *hint*. This difference is apparently one source of the problems illustrated in this chapter.

hints about the original Yukawa couplings.

(6) It is important to obtain accurate parameter values in order to gain information about the original Yukawa couplings.

(7) We hope that this uncertainty relation will be a hint to construct a more general form of the theory.

(7) We hope that this uncertainty relation will be useful in the construction of a more general form of the theory.

Note that (1) and (1*) express slightly different meanings. Example (1) would be appropriate in the situation that this line of argument exists within the overall method or approach of deducing "meaningful results" from these models. Example (1*), on the other hand, would be appropriate if this line of argument is in some sense external to this method or approach, perhaps being used in its derivation.

Chapter 65

however

The adverb *however* is commonly misused as a conjunction, as demonstrated by the following examples.

> (1) As we have seen, this model captures most of the general features of fracture formation, however, there are certain important characteristics for which it cannot account.
> (1) As we have seen, this model captures most of the general features of fracture formation. However, there are certain important characteristics for which it cannot account.
> (1*) As we have seen, although this model captures most of the general features of fracture formation, there are certain important characteristics for which it cannot account.
> (2) This value is larger than that predicted by the original theory, however it still does not agree with the experimental value.
> (2) This value is larger than that predicted by the original theory, but it is still inconsistent with the experimental value.

Because *however* is an adverb, it cannot be used to join two independent clauses, as in (1) and (2). In (1) this problem is solved by splitting the original into two sentences, while in (1*) it is solved by changing the first independent clause to a dependent clause. Although (1) and (1*) express essentially the same meaning, they differ in emphasis. The former emphasizes the fact that the model captures the general features, and thus this is seen as being the most important point. Contrastingly, the latter emphasizes that there are characteristics for which the model does not account. The emphasis of (1) seems to be closer to that intended by the author. The rewritten form, (2), seems to express exactly what the author of (2) intended. Here, again, this could be rewritten something like (1*), using the conjunction *although* (or *though*, *despite the fact that*, *while*, etc.), but this would change the emphasis. The mistaken use of "however" demonstrated in (2), where it can simply be replaced by *but*, is quite typical. In (1), however, such a change would result in awkwardness, because in the resulting sentence, it would be unclear whether "As we have seen" is meant to apply to only the first clause or to both clauses.

Chapter 66

in spite (of)

There are two types of problems I often encounter involving use of the adverbial expression *in spite*.[1]

66.1 Problems of grammar

Below I illustrate the most common grammatically mistaken uses of *in spite*.

> (1) In spite that the result does not depend on the initial conditions of f, it is very sensitive to the initial conditions of g.
> (1) In spite of the fact that the result does not depend on the initial conditions of f, it is very sensitive to the initial conditions of g.
> (1*) /Although/While/ the result does not depend on the initial conditions of f, it is very sensitive to the initial conditions of g.
> (2) In this case, the result can be obtained easily, in spite of the space Ω being infinite dimensional.
> (2) In this case, the result can be obtained easily, in spite of the fact that the space Ω is infinite dimensional.
> (2*) In this case, the result can be obtained easily, /in spite of/notwithstanding/despite/ the infinite dimensionality of the space Ω.
> (2**) In this case, the result can be obtained easily, even though the space Ω is infinite dimensional.
> (3) In spite of the peak value being much too large, the qualitative form of the theoretical curve is very similar to that obtained experimentally.
> (3) Although the peak value is much too large, the qualitative form of the theoretical curve is very similar to that obtained experimentally.
> (4) This divergence occurs in spite of that the energy remains finite.
> (4) This divergence occurs /in spite of/despite/ the fact that the energy remains finite.
> (4*) This divergence occurs even though the energy remains finite.

[1] Although in general *in spite of* corresponds directly to にもかかわらず, in comparison with this Japanese expression, the types of sentence structure with which *in spite of* can be used are limited. Use of this expression with the wrong type of sentence structure can lead to problems of both grammar and meaning.

(5) In spite of Jones proving $\alpha \geq 0$, the main problem remains unsolved.
(5) /In spite of/Despite/Notwithstanding/ Jones' proof that $\alpha \geq 0$, the main problem remains unsolved.
(5*) /Although/While/ Jones proved that $\alpha \geq 0$, the main problem remains unsolved.
(6) In spite of that ω and ω' are themselves independent, Eqs. (3.2) and (3.3) cannot be solved independently.
(6) /In spite of/Despite/ the independence of ω and ω' themselves, Eqs. (3.2) and (3.3) cannot be solved independently.
(6*) Although ω and ω' are themselves independent, Eqs. (3.2) and (3.3) cannot be solved independently.
(7) In spite of researchers making great efforts, no one has yet succeeded in developing a program that can pass the Turing test.
(7) /In spite of/Despite/Notwithstanding/ great efforts, no one has yet developed a program that can pass the Turing test.

There are two points raised by the examples above. The first is that when used with a meaning akin to *although* or *notwithstanding*, the noun *spite* can only be used in the set expression *in spite of.*[2] In particular, *spite* does not possess such a meaning standing alone, nor does it possess such a meaning in the expression *in spite* or *in spite that.* The second is a general point of grammar. The original sentences here illustrate how the use of a clause as the object of a preposition can result in awkwardness.[3] The clauses "that the...f" in (1), "that the...finite" in (4), and "that ω...independent" in (6) are noun clauses.[4] The clauses "the space...dimensional" in (2), "the peak...large" in (3), "Jones proving $\alpha \geq 0$" in (5), and "researchers making...efforts" in (7) are gerund clauses.[5] As demonstrated in (1), (2), (4) and (5), one way to solve the problems presented by the originals is to use a simple noun as the object of "in spite of" ("fact" in (1), (2) and (4), and "proof" in (5)) along with a relative clause[6] that gives a description of this noun.[7] In (2*), (5) and (6), the problem is solved by using the noun form of the adjective "dimensional," of the gerund "proving" and of the adjective "independent" as the object of "in spite of." (These nouns do indeed represent the important ideas of the original problematic clauses.) In (1*), (2**), (3), (4*), (5*) and (6*), "in spite of" is simply replaced by one of the closely related terms "although," "while" and "even though." To solve

[2] Grammatically, *in spite of* is a preposition.

[3] For additional discussion of this point, see Chapter 45.

[4] A noun clause begins with *that*, a question word (i.e. *who*, *what*, etc.), *if* or *whether*. It functions grammatically as a noun.

[5] A gerund clause is introduced by a gerund verb form (an '-ing' form). It too functions grammatically as a noun.

[6] A relative clause is a noun clause introduced by a relative pronoun. In each of the sentences here, this relative pronoun is "that." This is called a 'relative pronoun' because it refers to a noun. In each of the examples above, this noun acts as the object of "in spite of."

[7] In (1), (2), (4) and (5), we have the grammatical construction *in spite of + [noun] + [relative clause]*, where the relative clause describes *[noun]*. The only criterion governing the choice of the noun that acts as the object of *in spite of* is that it accurately represent that which is described by the relative clause that follows. Often, this relative clause describes what can be considered a *fact*, and for this reason, expressions of the form *in spite of the fact that...* are quite common.

the problem in (7), I have just removed unnecessary information: The reader can surmise that it is "researchers" who have been making these efforts without being told so explicitly. Finally, note that the expression "succeeded in developing" in (7) provides no more information than "developed" in (7).

66.2 Problems of meaning

In this section I treat a problem involving the use of *in spite of* that is conceptually somewhat more difficult than that considered above. This problem is demonstrated by the following.

> (1) The sum over the intermediate states leads to divergence, in spite of the coefficients.
> (1) The sum over the intermediate states leads to divergence, in spite of the attenuation of the coefficients.
> (2) We have thus obtained results consistent with experimental results, in spite of the low order model.
> (2) We have thus obtained results consistent with experimental results, in spite of the low order of our model.
> (3) In spite of the stochastic relationship (2.2) employed in its derivation, (4.3) is obviously deterministic.
> (3) In spite of our use of the stochastic relationship (2.2) in its derivation, (4.3) is obviously deterministic.
> (3*) Although the stochastic relationship (2.2) was employed in its derivation, (4.3) is obviously deterministic.

These sentences present problems of logic. In (1) it is implied that the divergence under consideration takes place in spite of the *existence* of the coefficients. The intended meaning, however, is that it takes place in spite of some property that they possess. Thus, in this sentence, "coefficients" should be changed to something like "the attenuation of the coefficients," as in (2), or *the convergence of the coefficients*, *the well-behaved nature of the coefficients*, etc. In the situation described by (2), the success of the model in question is not in spite of the existence of this model, as this sentence asserts. Rather, it is in spite of the model's low order. For this reason, "order," rather than "model" should be the object of "in spite of," as in (2). Similarly, the statement of (3) is that "(4.3)" is deterministic in spite of the existence of "(2.2)." The intended meaning, however, is that "(4.3)" is deterministic in spite of the use of "(2.2)" in its derivation, as expressed by the rewritten forms.

The grammatical role of the preposition *in spite of* is to introduce a prepositional phrase that modifies a verb. The semantic role of this prepositional phrase is that its object represents something that in itself makes the action or state expressed by the verb seem unlikely, unnatural or unexpected. The problem that most often accompanies use of *in spite of* is that the word or phrase acting as its object does not represent something of this type but, rather, an entity that possesses something of this type as a property, function, role, ability, etc. As seen from the above examples, this type of mistake leads to illogical statements.

Chapter 67

indispensable

The adjective *indispensable* is the antonym of *dispensable*. These words are derived from the verb *dispense*, as used in the sense of *dispense with*, which means *get rid of* or *eliminate*. For this reason, a noun modified by *indispensable* must possess such a meaning that its use as the direct object of the verbs *get rid of* and *eliminate* is logically feasible. In particular, *indispensable* cannot be used to modify a noun representing something that has only a potential existence.[1] This point is demonstrated by the following.

> (1) At this point, it is indispensable to apply the averaging procedure.
> (1) At this point, it is necessary to apply the averaging procedure.
> (2) Further effort in studying the $T < T_0$ behavior is indispensable to understanding how T_0 is approached.
> (2) Further effort must be made in studying the $T < T_0$ behavior to understand how T_0 is approached.
> (3) For this reason, a detection device with significantly greater resolution is indispensable to resolve these two effects.
> (3) For this reason, a detection device with significantly greater resolution is needed to resolve these two effects.

In (1), "indispensable" is being used to modify the clause "to apply..."[2] The problem with this modification is that "to apply..." refers to an action that only exists potentially; i.e., we are free to choose whether or not to carry it out. Compare this with the following.

> (4) This averaging procedure is indispensable in the treatment of a large class of systems.

Here, that which is modified by "indispensable" is "procedure." In contrast to the situations in the previous examples, this is not something whose existence is of a potential nature. Presumably, this is a well-defined, pre-existing mathematical procedure, and therefore, in this case "indispensable" is appropriate.

[1]It should be noted that *indispensable* imparts a connotation that is lacking in 必要, なくてはならない and 不可欠.

[2]This is an infinitive clause, which acts as a noun.

The problems with (2) and (3) are essentially the same as that described above, as both the "effort" and the "detection device" referred to there exist only potentially. Note that, as demonstrated by (3), the problem we consider here does not result from the abstract or intangible nature of that to which the modified noun refers. Rather, it is due to the potential nature of its existence. Thus, while the sentence *This large truck is indispensable in the performance of these jobs* is quite natural, *A large truck is indispensable in the performance of these jobs* is strange, because here no truck has been specified (as is clear from the use of the indefinite article "a"). In this case, it would be better to replace "indispensable in" with *necessary for*, *needed for* or *essential for*.

The most common problematic use of *indispensable* results from its modification of expressions that represent actions. The following are further typical examples.

(5) New data are indispensable to more precisely fix these values.
(5) New data are necessary to more precisely fix these values.
(6) It is indispensable to add this term.
(6) It is necessary to add this term.
(7) We have found it indispensable that these terms be added.
(7) We have found that these terms must be added.
(7*) We have found it necessary to add these terms.
(8) Performing these transformations in the proper order is indispensable.
(8) Performing these transformations in the proper order is /essential/required/.
(8*) It is necessary to perform these transformations in the proper order.
(9) In this case, averaging is indispensable.
(9) In this case, averaging is necessary.
(10) Hence it is indispensable to study the general situation in terms of the Hecke algebras of these rational functions.
(10) Hence it is /important/necessary/essential/ to study the general situation in terms of the Hecke algebras of these rational functions.
(10*) Hence, we must study the general situation in terms of the Hecke algebras of these rational functions.
(11) To study crust matter in neutron stars, realistic pairing strengths are indispensable.
(11) To study crust matter in neutron stars, realistic pairing strengths are /necessary/needed/essential/important/requisite/.
(12) Another mechanism should be indispensable to properly describe this hopping behavior.
(12) It appears that another mechanism is needed to properly describe this hopping behavior.
(13) It is indispensable to clarify this role.
(13) It is /necessary/important/essential/ to clarify this role.
(14) Knowledge of the behavior of the tunneling rate in the high-frequency region is indispensable for a comprehensive understanding of this behavior.
(14) Knowledge of the behavior of the tunneling rate in the high-frequency region is /needed/necessary/required/essential/ for a comprehensive un-

derstanding of this behavior.
(15) Gabor patches with unique spatial intervals should be indispensable in such a model.
(15) Gabor patches with unique spatial intervals are apparently /a necessary/an essential/ part of such a model.
(16) Numerical simulation is therefore indispensable.
(16) Numerical simulation is therefore /necessary/needed/required/essential/.

Here, (6), (10) and (13) demonstrate the improper use of “indispensable” with infinitive clauses, (7) with noun clauses, and (8) with gerund clauses.

Chapter 68

information

The noun *information* is frequently misused in the ways described in the following sections.

68.1 Use with *of* and possessive nouns

68.1.1 Proper use

Proper use of *information of*

In general usage modern English,[1] the preposition *of* can be used with *information* in the following manners.

> (1) Information of their results was requested.
> (2) These data are provided for the information of the reader in Appendix A.
> (3) We have information of a volcanic eruption off the coast of northern Russia.
> (4) The information of this configuration is a strictly increasing function of ρ.

In (1), "information" is used to mean something like *act of informing* or *communication.* Its meaning in (2) is clearly related to that in (1), but note that here the object of the preposition "of" represents not that which is communicated (as in (1)) but to whom this communication is made. In (2) "for the information" means something like *to supplement the knowledge*, and thus "information" is similar in meaning to *education.* (Note also that here "of" can be interpreted as expressing a meaning of possession.) Again in (3), the meaning of "information" is close to that in (1), but in this case, rather than referring to the communication itself, it refers to that which is communicated. In this sentence, "information" is synonymous with *knowledge.* In (4), "of" expresses a possessive meaning, and "information of" is synonymous with *information possessed by* or *information contained in.*

[1] In addition to the usages given here, there are several that the Oxford English Dictionary [4] characterizes as "obsolete," as well as several limited to special religious and legal contexts.

Proper use of *information* with possessive nouns

Because in (2) and (4) "of" expresses a possessive meaning, those sentences can be rewritten as follows.

> (2′) These data are provided for the reader's information in Appendix A.
> (4′) This configuration's information is a strictly increasing function of ρ.

The other sentences above, however, cannot be rewritten using possessive nouns, because in neither case does "of" express a meaning of possession. (In (1) and (3), "of" expresses meanings close to *regarding* and *concerning*, respectively.)

Discussion

There are several points to note with regard to the above examples. First, use of *information* with any of the meanings it possesses in (1)–(3) is somewhat limited in scientific writing. Second, while the meaning it expresses in (4) is indeed quite common in scientific and mathematical contexts, it is usually better to avoid such use of the preposition "of" and possessive noun forms to express the condition of possession, and instead use, for example, one of the synonymous expressions given above. Third, and most importantly in the considerations of this section, it should emphasized that the implication of (3) is that "we" simply know that the eruption in question occurred. If the intention were to state that we know about the nature of the eruption and are aware of certain details in its regard, then "of" should be changed to *about* or *concerning*. Misuse of *information of* in such situations is very common. We examine such misuse below.

68.1.2 Improper use

Improper use of *information of*

As discussed briefly above, in the situation that our knowledge concerning some entity or event is more than simply that of its existence or occurrence, it is inappropriate to use *information of* in regard to this knowledge. The following are typical examples of such misuse.[2]

> (5) These distribution functions contain information of quark-gluon correlations inside the nucleon.
> (5) These distribution functions contain information about quark-gluon correlations inside the nucleon.
> (6) The information of the transmitted wave function is contained in the propagator.
> (6) Information /about/concerning/ the transmitted wave function is contained in the propagator.

[2] The source of the problem here appears to be the direct translation of の in such expressions as 大脳が体から感覚の情報を受け取る as *of* or a possessive noun. In general, this is inappropriate.

(7) All the information of the strong interaction is contained in this hadronic tensor.
(7) All the information with regard to the strong interaction is contained in the hadronic tensor.

The implication of (5) is that the information contained in the distribution functions with regard to the quark-gluon correlations is simply that such correlations exist. Clearly this is not the intended meaning. The problems with (6) and (7) are similar.

There are a number of expressions that can replace *of* to properly convey the intended meaning in situations like those illustrated above. The following are some of those used most frequently: *about*, *regarding*, */with/in/ regard to*, *concerning*, *pertaining to*, *with respect to*, *in reference to*, *in relation to*, *relating to*, *in connection /to/with/*, *pertinent to*, *relevant to*. It should be realized here that, while these terms are (to varying degrees) similar, there are important differences among them with regard to the closeness and directness of the relations they describe. Here, I have listed them (roughly) in order of decreasing directness. In (5)–(7), I have simply chosen from the above expressions several that seem to faithfully express the authors' intentions. However, in each case there are several others that could be used quite naturally.

Finally, note that in the above original sentences, it seems possible that the authors intended to express a meaning of possession with "of." Clearly, however, in each case this is inappropriate. Examples in which such a mistaken intention is more clear are presented below.

Improper use of expressions of possession with *information*

As illustrated by (2), (2′), (4) and (4′) above, there are situations in which we can consider information to be possessed by some entity. However, I often find expressions of this kind employed in situations in which the idea of possession that they describe is inappropriate. Here I give some discussion of this point.

In the situation that some information reveals or helps to reveal the behavior, nature or state of some entity, we do **not** use possessive constructions indicating that this information belongs to this entity. In such situations, the relation between the entity in question and the information regarding it is not one of ownership. This is often a point of confusion for Japanese authors. The following are typical mistakes.

(8) The constellation's information has been gathered for more than ten years.
(8) Information /regarding/about/ the constellation has been gathered for more than ten years.
(9) Information of the secondary reaction was also gathered, but only to a limited extent.
(9) Information /about/concerning/ the secondary reaction was also obtained, but only to a limited extent.

The above original sentences seem to be describing information that is somehow contained within the "constellation" and the "reaction," but is not necessarily (in fact, probably not) *about* them. The situations described by these sentences seem

analogous to that of a clock and the information it – in some sense – contains. Clearly, however, this is not the intended meaning.[3]

Obviously, there are situations in which, in fact, it is appropriate to regard the information we seek as being possessed by the object of investigation. This is true, for example, in the study of DNA, where the information of interest is often that encoded by the molecule and not that which we have derived or gathered for its description. This is clearly different from the situations in (8) and (9). However, even in this case, although the possessive forms *the DNA's information* and *the information of the DNA* are possible, it is better to avoid these and use something like *the information encoded by the DNA*, *the information possessed by the DNA*, or *the information contained within the DNA*.

68.2 Plural form

In almost all situations, *information* is an uncountable noun.[4] Therefore, in general usage, modern English, it cannot be used in plural form, and it cannot be used with the indefinite article *an*. Consider the following.

(1) When writing a juzu in F_n, we often omit redundant informations.
(1) When writing a juzu in F_n, we often omit redundant information.
(2) Let us add to this formula an extra information regarding the internal interaction.
(2) Let us add to this formula an extra piece of information regarding the internal interaction.
(2*) Let us add to this formula extra information regarding the internal interaction.
(3) We need to study a wide variety of processes to extract a complete set of information.
(3) We need to study a wide variety of processes to extract a complete set of data.
(3*) We need to study a wide variety of processes to extract complete information.
(3**) We need to study a wide variety of processes to extract a set of values representing complete information.

As demonstrated by (2), in the situation that we wish to use *information* in a countable sense, the phrase *piece of information* is useful.[5] The problem with (3) is that the elements of a set can only be referred to using countable nouns, even when there is an uncountable number – in the mathematical sense – of such elements. Conversely, a collection or mass of some quantity represented by an uncountable noun cannot be referred to as a 'set'.

[3]Note that in (8) and (9), as in (5)–(7), several of the expressions listed above in addition to "regarding," "about" and "concerning" could be used in place of "of."

[4]Its functioning as a countable noun is limited to certain types of religious, legal and obsolete usages.

[5]Here, this expression is used in singular form. The plural form *pieces of information* can also be used. Similar expressions are commonly used with other uncountable nouns, for example, *types of behavior*, *pieces of evidence*, *bits of advice*.

68.3 Misuse with *know*

The noun *information* should not be used as the direct object of the verb *know*, and it should not be modified by the participle *known*.[6] Information is not something that we *know*, but rather something that we *have*. The following demonstrate misuses.

(1) We can then combine these results with the known information regarding the behavior of the solutions in regions I and II.
(1) We can then combine these results with previous results /describing/regarding/concerning/ the behavior of the solutions in regions I and II.
(1*) We can then combine these results with the known forms of the solutions in regions I and II.
(1**) We can then combine these results with the information we have regarding the behavior of the solutions in regions I and II.
(2) However, these results are all previously known information.
(2) However, these results are not new.
(2*) However, these results /contain/represent/provide/ no new information.
(2**) However, the information provided by these results is not new.
(2***) However, these results constitute previously existing information.

[6]The problem here apparently results from the direct translation of Japanese. It should be noted that 情報を知る does not translate as *know information* but, rather, */possess/have/ information*. Also, 情報を知らせる would generally become something like */provide/give/ information* or, simply, *inform*.

Chapter 69

instant vs. *instance*

In the papers I proofread, the nouns *instant* and *instance* are sometimes confused. In their correct usage, the former refers to a *time* (either a point in time or a time interval), while the latter refers to a *situation* that serves as an example or case of interest.[1] For this reason, *instant* can be (and very often is) used with the preposition *at*, but *instance* (when used with the meaning of 場合 or 例) cannot.

The following examples typify the misuses of *instant* and *instance* that I encounter.

(1) At the instance that the particle reaches the top of the potential, the two phases begin to separate.
(2) These terms cancel in the instant that we ignore the external field.

The statement in the first sentence is clearly with regard to a time, and thus "instance" should be changed to *instant*. Contrastingly, the second sentence obviously regards a situation. Here, "in the instant" could be changed to *in the instance*, *in the case* or *if*. In fact, *in the case* and *if* (which would express essentially identical meanings) seem more suitable, as *instance* is most naturally interpreted as referring to one of several specific examples or realizations. In the simplest situation described by (2), such an implication would be inappropriate. However, if the situation were such that we were considering several previously mentioned examples and in one of these we ignored the external field, *case* and *instance* would be equally natural, while *if* would be inappropriate.

[1] In most cases, *instant* can be translated as 瞬間 or 時点, and *instance* can be translated as 場合 or 例. While there are other meanings of these words, their use in scientific and technical writing is limited almost exclusively to these.

Chapter 70

issue

The noun *issue* is overused by Japanese authors. In most cases that I find it used, there are more appropriate terms. The following provide some such examples.[1]

(1) To provide a microscopic description of black holes in quantum gravity is a very important issue.
(1) To construct a microscopic description of black holes in terms of quantum gravity would /be a very important accomplishment/represent a very important advance/.
(2) Quantum chaos is a developing issue.
(2) Quantum chaos is a developing /subject/field/theory/.
(3) Chiral symmetry breaking is a key issue to be described in terms of non-perturbative dynamics of gauge theories.
(3) Chiral symmetry breaking is an important phenomenon to describe in terms of non-perturbative dynamics of gauge theories.
(4) We attempt to find necessary issues to establish the consistency of the two theories.
(4) We attempt to find /points of comparison/results/predictions/a method of comparison/ that can establish the consistency of the two theories.
(5) We first must introduce several new concepts to facilitate our generalized approach. The next two sections are devoted to this issue.
(5) ...The next two sections are devoted to this task.
(5*) ...This is done in the next two sections.
(6) Collective oscillatory behavior has been observed in many biological neuronal systems. Also, recent experimental observations suggest that the temporal coherence of neuronal oscillatory activity plays a key role in information processing of biological systems. In sight of these issues, we have reason to believe that the results of the present model may be useful in describing some aspects of information processing in real neuronal systems.
(6) ...In sight of these /facts/findings/results/, we have reason to believe that the results of the present model may be useful in describing some

[1] It seems that most of the misuses considered here result from the inappropriate translation of 問題 or 論点. Usually, these cannot be translated as *issue*.

aspects of information processing in real neuronal systems.
(7) The extension of this model to the general case is a non-trivial issue.
(7) The extension of this model to the general case is a non-trivial /task/problem/undertaking/.
(8) Therefore the four-dimensional problem is reduced to the two-dimensional issue.
(8) Therefore the four-dimensional problem is reduced to the two-dimensional problem.
(9) It is not clear, however, how this effect can be incorporated into the present model. We would like to make progress toward answering this issue.
(9) ...We would like to make progress toward answering this question.
(10) The characteristic length scale of the dynamics of supercooled liquids near the glass transition is the most important key issue here.
(10) The characteristic length scale of the dynamics of supercooled liquids near the glass transition is the most important /quantity/concept/ here.
(10*) /Understanding/Describing/Deriving/ the characteristic length scale of the dynamics of supercooled liquids near the glass transition is the most important problem here.
(11) It is an important issue to confirm that for SSB the light-front formulation yields the same result as the equal-time formulation.
(11) It is important to confirm that for SSB the light-front formulation yields the same result as the equal-time formulation.
(12) In the description below, we include some rudimentary issues of statistical physics in order to make the paper self-contained.
(12) In the description below, we cover some rudimentary topics of statistical physics in order to make the paper self-contained.
(12*) In the description below, we cover some rudiments of statistical physics in order to make the paper self-contained.
(13) One of the most important issues is the pinning of vortices at defects.
(13) One of the most important phenomena is the pinning of vortices at defects.
(13*) One of the most important problems is to describe the pinning of vortices at defects.
(14) Competition between superconducting and CDW ordering is an important issue for this class of materials.
(14) The competition between superconducting and CDW ordering plays an important role in determining the behavior of this class of materials.
(14*) Competition between superconducting and CDW ordering is a characteristic phenomenon of this class of materials.
(14**) Describing the competition between superconducting and CDW ordering is an important step in constructing a theory for this class of materials.

In many of the examples above "issue" misrepresents that to which it refers. In others it is simply too vague.

Chapter 71

just

The adverb *just* has many meanings. Its use with some of these meanings, however, should be avoided in formal written work. In the following sections I discuss typical examples.

71.1 Misused to mean *simply* or *only*

Use of *just* to mean *simply* or *only* should be avoided. There are two reasons for this. First, such usage is quite informal. Second, and more importantly, because *just* has many meanings, this usage often results in ambiguous statements. For example, the sentence *We just calculated the value of* α could be interpreted to mean *We only calculated the value of* α, *We simply calculated the value of* α, or *We calculated the value of* α *very recently*. The following are further examples of this kind.

(1) In the next section, we just perform the linear analysis.
(1) In the next section, we /simply/merely/ perform the linear analysis.
(1*) In the next section, we perform only the linear analysis.
(2) This result is just a reflection of the sensitivity of ρ to changes in γ.
(2) This result is /simply/merely/ a reflection of the sensitivity of ρ to changes in γ.
(2*) This result is a reflection only of the sensitivity of ρ to changes in γ.
(3) In this case, for the final step, we just substitute $\tilde{\alpha}$ for α in (5.5).
(3) In this case, for the final step, we /simply/merely/ substitute $\tilde{\alpha}$ for α in (5.5).
(3*) In this case, for the final step, we substitute only $\tilde{\alpha}$ for α in (5.5).
(4) This, however, is just true in some very simple cases.
(4) This, however, is true only in some very simple cases.
(5) In this case, δ is just greater than a_1.
(5) In this case, δ is only slightly greater than a_1.
(5*) In this case, δ is greater than only a_1.

Although (1) and (1*) are similar, there is an important difference in emphasis. The former implies that nothing other than the linear analysis appears in "the next

section" – that it contains, for example, no discussion. By contrast, the latter implies only that the analysis appearing in that section is limited to linear order. In particular, it does not imply that this analysis is the only thing that the section contains. The difference between (2) and (2*) is more significant. The meaning of (2) is that "this result" has a simple explanation, whereas the meaning of (2*) is that "this result" is caused solely by the "sensitivity of ρ to changes in γ." Example (3), which expresses the idea that this final step is simple, clearly represents the most natural interpretation of (3), but (3*), which has the meaning that $\tilde{\alpha}$ and nothing else is substituted for α, is also possible. That described by (4) would seem to be the only possible interpretation of (4). The final example is somewhat different from the first four. In this case, it is possible to understand "just" as meaning "only slightly," as expressed in (5). The second way that this sentence can be construed is with the meaning of (5*), that δ is greater than a_1 but not greater than anything else.

71.2 Misused to mean *precisely*, *exactly* or *identically*

While *just* can be used to mean something like *precisely*, *exactly* or *identically*, for the reasons given in the previous section, this too should be avoided. The examples below typify this problematic use.

(1) We see that the resulting shape is just that of the chamber 123456.
(1) We see that the resulting shape is /precisely/identically/exactly/ that of the chamber 123456.
(2) A sharp emission peak appears just at the two-photon energy of the incident laser.
(2) A sharp emission peak appears /precisely/exactly/ at the two-photon energy of the incident laser.
(2*) A sharp emission peak appears only at the two-photon energy of the incident laser.
(3) The resulting manifold is just $\bar{X}(n+3)$.
(3) The resulting manifold is identically $\bar{X}(n+3)$.
(3*) The resulting manifold is $\bar{X}(n+3)$.
(3**) The resulting manifold is simply $\bar{X}(n+3)$.
(3***) The resulting manifold is only $\bar{X}(n+3)$.
(4) The value $|\beta|$ increases just as much as θ in this range.
(4) The value $|\beta|$ increases by the same amount as θ in this range.
(4*) The quantities $|\beta|$ and θ increase by the same amount in this range.
(5) These curves just coincide.
(5) These curves coincide.
(6) Just as in Ref. [4], we use the smoothing procedure introduced by Stevens.
(6) As in Ref. [4], we use the smoothing procedure introduced by Stevens.
(6*) We use the smoothing procedure introduced by Stevens in precisely the same manner as in Ref. [4].

In (1), "identically" and "exactly" have the same meaning. "Precisely" here means *with high precision*, and thus, unlike "identically" and "exactly," its use does

not imply that these shapes are identical. The situation in (2) is similar. Here, "exactly" would only be appropriate in the case that this sentence is describing a theoretical result and that, according to this result, the value of the energy at the "sharp emission peak" coincides with the value of the "two-photon energy." The completely different meaning expressed by (2^*) represents another very natural interpretation of the original. A number of interpretations are possible for (3). The rewritten forms (3) and (3^*) express the same meaning, and unless some special emphasis is intended, (3^*) is preferable. The implication of (3^{**}) is that the result in question is in some sense simple. Although (3^{***}) is somewhat unusual, it is not an unfeasible interpretation of the original. Its meaning is that the resulting manifold consists of nothing in addition to $\bar{X}(n+3)$. Thus, although it is basically the same as (3) and (3^*), its emphasis makes it inappropriate in all but certain special situations. Perhaps the simplest such situation would be that in which, prior to the derivation of this result, it was thought possible that the manifold is composed only in part of $\bar{X}(n+3)$. The meanings expressed by (4) and (4^*) are identical. The use of "just" in (5) seems to imply that the condition of coincidence exists in varying degrees. In the case of (6), if it is sufficient to simply state that the present work employs the same smoothing procedure as Ref. [4], then (6) is appropriate, but if it is also necessary to specify that this procedure is employed in the same manner, then (6^*) is the best choice.

71.3 Misused in expressions with *order*

The following use of *just* should be strictly avoided.

(1) Σ_* is just of the order of the domain size, ξ.
(1) Σ_* is of the same order as the domain size, ξ.

71.4 *just equal* misused to mean *equal* or *identical*

I sometimes encounter the expression *just equal.* In general, in scientific contexts, the condition of *equality* does not exist in degrees, and thus the meaning imparted by *just* here is inappropriate. The example below demonstrates how this problematic expression is often used.

(1) The value we obtained, $\sigma/2$, is just equal to that predicted by mean-field theory.
(1) The value we obtained, $\sigma/2$, is /equal to/identically/exactly/ that predicted by mean-field theory.

71.5 Misused to mean *recently*

This is simply a matter of style, but in scholarly writing, it is usually better to avoid *just* to express the meaning of *recently*, as illustrated by the following.

(1) Our results are then compared to experimental results just obtained.
(1) Our results are then compared to /recent/recently obtained/ experimental results.

Chapter 72

key

There are two problems I often encounter involving use of the noun *key*.

72.1 Grammatical problem

The sentences below demonstrate a common grammatical mistake.

> (1) This is the key to derive the solution we seek.
> (1) This is the key to deriving the solution we seek.
> (2) We believe that this is indeed the key to understand the entire class of behavior we consider.
> (2) We believe that this is indeed the key to understanding the entire class of behavior we consider.

In the construction *A is the key to B*, the expression "key to" is a grammatical set. Here, "to" can only act as a preposition, and B must be its object (and therefore a noun). There are two ways to interpret (1). One interpretation is that the author is using "to derive" as a to-infinitive. In this case, however, "key to" would not form a grammatical set. The second interpretation is that "key to" does form a grammatical set and thus that "to" is being used as a preposition. However, in this case, the result would be grammatically incorrect, because this preposition has no object. In (1), "deriving the solution we seek" is a noun,[1] acting as the object of "to." The second example is similar.

Now, consider the following.

> (3) This might be a key to study neutron stars.
> (3) This might be a key to studying neutron stars.
> (3*) This might be a key to the study of neutron stars.

In this case, it is not clear if "study" in the original is being used as a noun or a verb. The two possible grammatical interpretations are reflected by the two rewritten versions.

[1]This is a gerund clause, introduced by the gerund "deriving." Gerunds and gerund clauses act grammatically as nouns.

72.2 Misuse with *of*

As demonstrated above, *key* can be used in grammatical constructions like *[noun] + is the key + [preposition] + [gerund clause]*. In such constructions, however, the preposition must be *to*. Sometimes I find *of* used mistakenly in its place, as in the following.

> (1) This is perhaps the key of understanding the quantum nature of the gravity.
> (1) This is perhaps the key to understanding the quantum nature of gravity.

Chapter 73

knowledge

73.1 Misused in place of *information* or *understanding*

In general, the noun *knowledge* should not be used in place of *information* or *understanding*. The reason for this is that *knowledge* is much broader in meaning,[1] and therefore it can be both ambiguous and inappropriate when used in such roles. The following is typical of such misuse.

(1) These studies have provided improved knowledge of these systems.
(1) These studies have provided an improved understanding of these systems.
(1*) These studies have provided new information regarding these systems.

Here, while "improved knowledge" is not necessarily wrong, depending on what "these studies" have actually provided, either "improved understanding" or "new information" is probably more precise and thus preferable. In particular, (1*) would be more appropriate in the case that, for example, these studies have allowed us to assemble a new set of facts regarding these systems, but we have not yet been able to process these facts in such a way to obtain a clearer and deeper picture. Contrastingly, (1) implies that such a picture has been obtained, although this might not be the result of assembling new facts. The original here could be interpreted as meaning either of these, or something else.

Below, I further illustrate the type of problem demonstrated by (1).

(2) These data represent new knowledge that should be helpful in pinning down the properties of this family of particles.
(2) These data represent new information that should be helpful in pinning down the properties of this family of particles.
(3) Through the analysis and discussion given in the final section, we gain improved knowledge of our results and their meaning in application to Riemannian manifolds.
(3) Through the analysis and discussion given in the final section, we

[1] According to The American Heritage Dictionary of the English Language [1], *knowledge* includes facts and ideas, understanding, and the totality of what is known.

gain an improved understanding of our results and their meaning in application to Riemannian manifolds.
(4) Our knowledge regarding these systems has become clearer.
(4) Our knowledge regarding these systems has increased.
(4*) Our understanding of such systems has become clearer.
(5) These studies have provided deeper knowledge of general aspects of the transition to turbulence.
(5) These studies have provided a deeper understanding of general aspects of the transition to turbulence.
(6) We will no doubt change our approach as our knowledge on confinement becomes clearer.
(6) We will no doubt change our approach as our understanding of confinement becomes clearer.
(6*) We will no doubt change our approach as information on confinement increases.
(7) We propose to describe this behavior using the knowledge of two- and three-body interactions of baryons.
(7) We propose to describe this behavior using the /information regarding/descriptions of/a model of/our understanding of/ two- and three-body interactions of baryons.
(8) From knowledge of the physiological studies, it is known that the activity level of real neural systems is low.
(8) From physiological studies, it is known that the activity level of real neural systems is low.

The problem with (2) is that, in general, data are more naturally considered a form of information than a form of knowledge. Usually, we do not think of data as representing knowledge but, rather, something from which knowledge can be derived. The examples (3)–(6) are useful in distinguishing the meanings of *knowledge* and *understanding*. In scientific discussion, it is usually more appropriate to refer to the descriptive picture we have obtained of some object of study as an 'understanding' than as 'knowledge'. In general, *knowledge* has a wider meaning and includes information and ideas that have not yet been sufficiently processed to be incorporated into such a picture. For this reason, modifiers that describe quality, like *improved*, *clearer* and *deeper*, are usually more appropriately applied to *understanding* than to *knowledge*. Contrastingly, modifiers that describe quantity, like *greater*, *more extensive* and *increased*, are quite natural with *knowledge*, while they are entirely inappropriate with *understanding*. As (6) illustrates, the expression "knowledge on" is unnatural. Of the three words considered here, only *information* can be used with the preposition *on*. The use of "knowledge" in (7) is quite vague. Also, this use of "the" is inappropriate, because it seems to imply that such "knowledge" can be precisely specified. As we have discussed throughout this chapter, in general, knowledge is not something of this nature. In (8), "knowledge" is simply superfluous.

73.2 Misused as a countable noun

Usually, *knowledge* is an uncountable noun.[2] Its misuse as a countable noun is exemplified by the following.

> (1) The knowledge of this distribution at one time is sufficient to determine it at all times.
> (1) Knowledge of this distribution at one time is sufficient to determine it at all times.
> (2) According to these knowledges, we can proceed to the analysis of specific examples.
> (2) With this /knowledge/understanding/, we can proceed to the analysis of specific examples.
> (3) The great knowledges of biological systems we have gained since the time of Darwin have perhaps made us forget how great his insight was.
> (3) The extensive knowledge of biological systems we have gained since the time of Darwin has perhaps made us forget how great his insight was.

[2]There are exceptions to this rule, however, as demonstrated by the following: *The knowledge necessary to fly a jet airplane is extensive*; *A basic knowledge of etiquette is essential to live in any society*; *The knowledge of classical Greece was largely destroyed by religious zeal.*

Chapter 74

largely vs. *greatly*

The adverbs *largely* and *greatly* can both be used to mean *to a great extent* or *on a large scale*. However, because these are the primary definitions of *greatly* and only the secondary definitions of *largely*, when the intended meaning is something of this kind, for the sake of precision and clarity it is usually better to use *greatly*. Often when *largely* is used to express such a meaning, it can be misinterpreted as a synonym of *for the most part*, *mainly*, *by and large* or *essentially*, which are its primary meanings in present-day usage.[1] The following is a typical example of this type of problematic use.

(1) This effect is largely enhanced in the mixed domain.
(1) This effect is /greatly/significantly/ enhanced in the mixed domain.

In the original, "largely" appears to be qualifying the meaning of "enhanced," and judging from the use of this word alone, this sentence would be understood as implying that, while the effect is mainly enhanced, there are certain cases or regions in which it is not enhanced. Considering the entire sentence, however, it seems more likely that the intended meaning is that expressed unambiguously by (1).

The examples below further illustrate common misuses of *largely*.

(2) This result is largely different from the first.
(2) This result differs /greatly/significantly/ from the first.
(3) While this effect is slightly enhanced by the interaction term, it is largely suppressed by the fourth-order derivative term.
(3) While this effect is slightly enhanced by the interaction term, it is strongly suppressed by the fourth-order derivative term.
(4) Even at this high temperature, the lowest energy configuration remains largely populated.
(4) Even at this high temperature, the population of the lowest energy configuration remains large.
(5) However, τ does not depend largely on the system size.
(5) However, τ does not depend strongly on the system size.
(6) The average vesicle size does not change largely.
(6) The average vesicle size does not change /greatly/significantly/.

[1] See, for example, The American Heritage Dictionary of the English Language [1].

Each of the originals here is meant to be a statement regarding size, strength or extent, but the misuse of "largely" results in some other meaning. The connotation of (2) is that these two results differ in most cases. From (3), the reader is led to believe that the fourth-order derivative term suppresses the effect in question in some respects (or in some cases, at some times, in some ways, etc.), but not all. The most natural interpretation of (4) is that at most times or in most cases the lowest energy state is populated. However, this is most certainly not the situation that the author wished to describe. Strictly interpreted, (5) and (6) simply do not make sense.

The following illustrate proper uses of *largely*.

> (7) The asymptotic behavior of $R(t)$ is largely unaffected by the perturbation.
> (8) Their analysis was largely of a qualitative nature.
> (9) This uncertainty is due largely to that in measuring the durations of individual events.
> (10) The appropriateness of this approach largely depends on the validity of the first of these assumptions.

The meaning of (7) is that in most respects (or by most measures) the behavior under consideration is unaffected (or not significantly affected). The assertion of (8) is that "their analysis" was mainly or most importantly qualitative. From (9), the reader can conclude that, although there are other sources, the major source of error lies in the measurement of the stated durations. The implication of (10) is that there are other factors involved in determining the appropriateness of the approach in question, but the most important factor is the validity of the specified assumption.

Chapter 75

later, *earlier* and other time-like words

In general, when reference is made in a paper to something contained in the same paper, terms with time-like meanings, such as *earlier*, *before*, *previously*, *later* and *after*, should be avoided. Use of such terms can create confusion, as demonstrated by the following.[1]

> (1) We will demonstrate this point later.
> (1) We demonstrate this point below.
> (1*) We demonstrate this point in /a subsequent/the next/ section.
> (2) We thus obtain a result analogous to that obtained earlier for the spin 1 case.
> (2) We thus obtain a result analogous to that obtained above for the spin 1 case.
> (2*) We thus obtain a result analogous to that obtained in /the previous section/Section 2/ for the spin 1 case.
> (3) Let us now reconsider some solutions derived before.
> (3) Let us now reconsider some solutions derived above.
> (3*) Let us now reconsider some solutions obtained in previous sections.

The original sentences here seem to be referring to things that do not appear in the present paper: (1) could be interpreted as meaning that the "point" of interest will be demonstrated in a subsequent paper, and (2) and (3) appear to be referring to a result and solutions derived in previous papers. The rewritten versions of these sentences present some expressions that can be used in place of the problematic time-like terms.

[1] As the examples here demonstrate, in scholarly papers, it is best to avoid using time-like expressions to convey the meanings of 以上, 以下, 前述, 後述, etc.

Chapter 76

meaning

I often find the noun *meaning* used in situations that certain other terms are more appropriate. Here I present a number of examples.

76.1 *meaning* vs. *implication*

76.1.1 Introduction

The word *meaning* is often incorrectly used in place of *implication*. To avoid this misuse, there are two points regarding the meanings of these words that must be understood.

The first point to consider here is that, in the sense that it is generally used in scientific and mathematical writing, *meaning* refers to something possessed only by *expressions* (linguistic, mathematical, logical, etc.), while *implication* refers to something that can be possessed by many types of things, including expressions. This difference can be understood by considering the following.[1]

> (1) The meaning of this extremely slow decay of $\sigma(x, x')$ is that the second-order expansion is insufficient in the computation of ρ.
> (1) The implication of this extremely slow decay of $\sigma(x, x')$ is that the second-order expansion is insufficient in the computation of ρ.

The import of (1) is that the decay of $\sigma(x, x')$ itself possesses meaning. However, such a situation would only be possible if this decay were understood as an *expression* of some kind. While this is not entirely impossible, it is quite unnatural, and for this reason, "implication" is more appropriate than "meaning" here. Now, compare the above example with the following.

> (2) The meaning of Eq. (4.11) is that because of the extremely slow decay of $\sigma(x, x')$, the second-order expansion is insufficient in the computation of ρ.

[1] Note that the sentence *This extremely slow decay of* $\sigma(x, x')$ *means that the second-order expansion is insufficient in the computation of* ρ is equivalent in meaning to (1) and similarly problematic. In this sentence, "means" should be replaced by *implies*.

Here it is implied that "Eq. (4.11)" expresses the idea that the slow decay of $\sigma(x, x')$ is responsible for the insufficiency of the second-order expansion. In contrast to the situation in (1), this is quite natural, and therefore in this case "meaning" is appropriate. Note that if "meaning" were changed to *implication* here, the assertion of the resulting sentence would be – rather than that Eq. (4.11) itself expresses the idea regarding the cause of the insufficiency of the second-order expansion – that this idea can be derived from Eq. (4.11). Below I give further discussion of this difference.

The second point to consider with regard to the use of these words is that, generally, the meaning of an expression is intrinsic to it, while the implication of an expression is extrinsic and inferred from its meaning. Thus, for example, the meaning of an argument, equation or statement is the idea it conveys, while the implication includes anything that follows from this idea logically, either directly or indirectly. This difference, which was discussed above in reference to (2), is further illuminated by the following.

> (3) The meaning of this result is that e_i and e_j $(i \neq j)$ become independent as t becomes large.
> (4) The implication of this result is that e_i and e_j $(i \neq j)$ become independent as t becomes large.

Although both of these are quite natural, their meanings differ. The meaning of (3) is that "this result" itself describes the evolution toward independence of e_i and e_j, whereas the meaning of (4) is that knowledge of this behavior cannot be known directly from "this result" but somehow can be derived from it.

76.1.2 Examples

Now, consider the following example.

> (5) These terms cancel exactly if we ignore the small effect on the fluid flow due to the directional asymmetry of the membrane, and D thereby diverges, rendering the theory meaningless. Properly taking this effect into account, however, the theory in fact predicts oscillation frequencies well within their experimentally measured ranges. The meaning of this asymmetry is thus profound.

Here, clearly "meaning" should be replaced by *implication*. On one level, this implication can be thought of as the significance of this "effect" within the model in question in the realization of a successful theory. On another level, it can be regarded as the large effect caused by this asymmetry in a certain kind of physical system. Thus the profundity referred to here regards the importance of the role played by the asymmetry in the behavior of this system and thereby in its mathematical modeling. The *meaning* of the asymmetry, on the other hand, is that the effect of the membrane on fluid flow depends on the direction of the flow. It is not appropriate to refer to this as "profound."

The situation is similar in the following example.

(6) When $\mathcal{F}(x,t)$ is invariant under time reversal, however, these curves coincide over a finite interval, and thus the above theorem asserting the non-decreasing nature of S no longer applies. In fact it can be shown in this case that S in general decreases. The meaning of the physical realizability of certain time-reversal invariant forms of $\mathcal{F}(x,t)$ is thus that the analogy between S and the thermodynamic entropy is not perfect.

Here again, *implication* is more appropriate than "meaning," as the conclusion that the analogy under consideration is not perfect certainly cannot be regarded as the idea conveyed by the physical realizability of the time-reversal invariant forms. Clearly, the former is separated from the latter by several arguments.

Finally, consider the following.

(7) We thus reach the conclusion that the effect of the anisotropy of the fluctuations is significant in the $\gamma > \gamma_c$ regime. One meaning of this conclusion is that the treatment presented in this paper is not sufficient for describing this regime.

The important point here is that the expression "meaning of a conclusion" is unnatural, because usually there is no distinction between a conclusion and the meaning it conveys. If we change "meaning" to *implication*, however, this problem no longer exists.

76.1.3 Related terms

In situations like those studied in the present section, in addition to *implication*, expressions that can often be used correctly in place of *meaning* include *connotation*, *import*, *purport*, *significance*, *substance*, *inference*, *inferred meaning* and *implicit meaning*.

76.2 Other misuse

Below I give a number of examples illustrating other situations in which *meaning* is used when the author's intention would be more clearly expressed by some other word.

(1) In this case, $\tilde{\Phi}_{LR}$ has the meaning of a bi-local field.
(1) In this case, $\tilde{\Phi}_{LR}$ /represents/is/constitutes/ a bi-local field.
(2) This simplification has the meaning of the Markov approximation.
(2) This simplification is equivalent to the Markov approximation.
(2*) This simplification /constitutes/represents/ the Markov approximation.
(3) We discuss the meaning of this experimental observation in the final section.
(3) We discuss the /significance/implication/ of this experimental observation in the final section.
(4) Let us consider the meaning of the decision-making function of the

first player.
(4) Let us consider the /role/significance/ of the decision-making function of the first player.
(4*) Let us interpret the decision-making function of the first player.
(5) The soliton equation has the geometrical meaning of the zero-curvature equation.
(5) The soliton equation has the geometrical interpretation as the zero-curvature equation.
(5*) Geometrically, the soliton equation /is equivalent to/represents/constitutes/is/ the zero-curvature equation.
(6) Hence $\frac{G_1}{G_0}$ has the meaning of a frictional force.
(6) Hence $\frac{G_1}{G_0}$ can be interpreted as a frictional force.
(6*) Hence $\frac{G_1}{G_0}$ /represents/constitutes/is/is equivalent to/plays the role of/ a frictional force.

Chapter 77

meanwhile

The adverb *meanwhile*[1] should not be used as a synonym of *and*, *also*, *in addition* or *but*. Also, it should not be used to simply change the topic of discussion. This word necessarily has a time-like implication, and it can only be used to mean something like *at the same time* or *during that time*. Below I present typical mistaken usages.[2]

> (1) The smallest three eigenvalues are all negative. Meanwhile, the corresponding eigenfunctions are monotonically decreasing functions of x.
> (1) The smallest three eigenvalues are all negative, and the corresponding eigenfunctions are monotonically decreasing functions of x.
> (2) In the $\Omega \to \infty$ limit, the trace of M vanishes. Meanwhile its determinant diverges.
> (2) In the $\Omega \to \infty$ limit, the trace of M vanishes, /and/but/while/ its determinant diverges.
> (3) Theorem 1 applies to the first case when the second derivative vanishes and the second case when it does not. Meanwhile Theorem 2 applies to the first case when the second derivative is positive and the second case when the first derivative vanishes and the second derivative is negative.
> (3) Theorem 1 applies to the first case when the second derivative vanishes and the second case when it does not. Theorem 2 applies to the first case when the second derivative is positive and the second case when the first derivative vanishes and the second derivative is negative.
> (4) The coefficient C is 0 for a regular spike sequence, and meanwhile is 1 for a simple Poisson process.
> (4) The coefficient C is 0 for a regular spike sequence and 1 for a simple Poisson process.
> (5) Here, $\tilde{\tau}$ is typically much larger than the membrane time constant of ten milliseconds and meanwhile much shorter than the delay period of a few seconds.

[1] This word can also be used as a noun.

[2] Obviously, the statements made in this chapter regarding the use of *meanwhile* hold also for the synonymous expressions *in the mean time (meantime)* and *in the mean while (meanwhile)*. However, misuse of the type discussed here involving these expressions is rare.

(5) Here, $\tilde{\tau}$ is typically much larger than the membrane time constant of approximately ten milliseconds, but much shorter than the delay period of a few seconds.

(6) For systems of this type, the ordinary perturbative treatment is not applicable, meanwhile the treatment proposed in the previous section is too complicated to be useful.

(6) For systems of this type, the ordinary perturbative treatment is not applicable, while the treatment proposed in the previous section is too complicated to be useful.

(7) This formalism was originally developed to treat statistical models, and it has been very successful in this role. Meanwhile, it has been found that there are many other contexts in which it can be applied.

(7) This formalism was originally developed to treat statistical models, and it has been very successful in this role. Since its development, however, it has been found that there are many other contexts in which it can be applied.

Among these examples, (2) and (7) warrant discussion. Note that (2) is close to describing something of a time-like nature, as we could think of taking the limit referred to here by increasing Ω in time. However, this use of "meanwhile" is unnatural even in such a case, because its time-like implication is too literal. (Somehow it seems to imply that the determinant diverges at some specific time on some specific day.) Next, consider (7). Although this sentence does indeed describe certain developments that took place over time, the use of "meanwhile" here too is problematic. In order to use "meanwhile" in this manner, there must be some previously expressed period of time to which it refers. However, in the original, there is nothing of this kind. The intention here is for this period of time to be that since the development of the model, as expressed in (7).

Now, compare the above examples with the following proper uses of *meanwhile*.

(8) There have been a number of interesting developments in the thermodynamic theory of small systems on this scale since the groundbreaking work presented in Ref. [1]. Meanwhile, technical advances have made possible many new types of experiments on such systems that can be used to directly test this theory.

(9) For many years, increasingly elaborate experiments employing the same basic principles and techniques have been carried out in an attempt to extract a few more details concerning the behavior of these systems. Meanwhile, there has been a little-noticed effort by a few people to develop an entirely new set of experimental methods that just recently began producing some startling results.

Chapter 78

monotonous and *monotonously*

In general usage, the adjectives *monotonous*, *monotone*[1] and *monotonic* all possess the meaning of 単調な, while the adverbs *monotonously* and *monotonically* possess the meaning of 単調に. However, in mathematical usage, only *monotone*, *monotonic* and *monotonically* can be used to express such meanings. The following illustrate common mistakes.

> (1) It should be noted that the growth rate is a monotonous function of ρ.
> (1) It should be noted that the growth rate is a /monotone/monotonic/ function of ρ.
> (2) Let us consider the case in which the pressure is a monotonously increasing function of x.
> (2) Let us consider the case in which the pressure is a monotonically increasing function of x.

Because *monotonous* and *monotonously* possess no mathematical meaning, the types of usage demonstrated by (1) and (2) result in absurd assertions.

[1] *Monotone* can also be used as a noun.

Chapter 79

more and *less*

There are several ways that *more* and *less* are misused. The most common of these are illustrated by the following examples.

79.1 *more* and *less* misused to modify verbs

Although *more* and *less* can be used as adverbs, in this role, they are usually used to modify adjectives or other adverbs. In general, their use in modifying verbs should be avoided, because when used in this way, they will usually be construed with the meanings of *more often* and *less often*. This type of problem is illustrated by the following.[1]

> (1) In such cases, we tend to underestimate these values more.
> (1) In such cases, we tend to underestimate these values by a greater amount.

The meaning of (1) seems to be that this underestimation occurs *more often* (than something else). The examples below are similar.

> (2) Here, the $\Lambda\Lambda$ final states were observed /more/less/ than the prediction of the INC model.
> (2) Here, the number of observed $\Lambda\Lambda$ final states was /greater/less/ than the number predicted by the INC model.
> (2*) Here, there were /more/fewer/ observed $\Lambda\Lambda$ final states than predicted by the INC model.
> (3) Increasing the water fraction more, the system returns from the gel phase to the fluid phase.
> (3) Increasing the water fraction further, the system returns from the gel phase to the fluid phase.
> (3*) Increasing the water fraction by a greater amount, the system returns from the gel phase to the fluid phase.
> (4) When Λ is larger than c, polymer lipids move to higher curvature

[1] The problems illustrated in this section apparently result from the careless translation of さらに or より as *more*. Often, such translations are not possible.

regions, and as a result, the curvatures of these regions grow more.
(4) When Λ is larger than c, polymer lipids move to higher curvature regions, and as a result, the curvatures of these regions increase further.

79.2 *more* misused to mean *additional*

Use of *more* to mean *additional* often results in ambiguous statements.[2] The following is typical.

(1) The field equations impose more conditions on this form.
(1) The field equations impose /further/additional/ conditions on this form.
(1*) The field equations impose a larger number of conditions on this form.

The original sentence here is ambiguous. It could be interpreted with the meaning expressed by either (1) or (1*). The meaning of (1) is that the field equations impose conditions that are additional to those already imposed, whereas the meaning of (1*) is that these equations impose a larger number of conditions than something else imposes. The examples below present similar problems.

(2) In this case, the oscillator network is capable of retrieving more detailed information.
(2) In this case, the oscillator network is capable of retrieving additional detailed information.
(2*) In this case, the oscillator network is capable of retrieving information of greater detail.
(3) It is therefore necessary give more theoretical consideration of this system from various points of view.
(3) It is therefore necessary to further study this system theoretically from various points of view.
(3*) It is therefore necessary to study this system from various points of view in a more theoretical manner.
(4) This work presents more thorough investigation.
(4) This work presents /further/additional/ thorough investigation.
(4*) This work presents a more thorough investigation.

The reason that ambiguity results from the use of *more* demonstrated above is that this word can act as either an adjective or an adverb, and thus when it appears in a construction of the form *more + [adjective] + [noun]*, it can sometimes be unclear whether it is modifying the adjective or the noun. For example, in (2), if we interpret "more" as an adjective, then it modifies "information," and the resulting meaning is that of (2), while if we interpret it as an adverb, it modifies "detailed," and the resulting meaning is that of (2*). The problems in (3) and (4) are similar. It is interesting to compare (4) and (4*). In (4), "more" could be interpreted as

[2]The misuse discussed here seems to result from the translation of 追加の as *more*. Usually this is inappropriate.

modifying either "thorough" or "investigation." In (4*), however, it can only be interpreted as modifying "thorough." The reason for this difference is that in (4), because there is no article, "investigation" is an uncountable noun, while in (4*), because the article "a" appears, "investigation" is a countable noun.[3]

[3]The point here can be understood by noting that the expression *more investigation* (in which "investigation" is necessarily uncountable) is possible, but *a more investigation* is not.

Chapter 80

multiply

80.1 Grammatical problems

The most frequently appearing grammatical misuse of the transitive[1] verb *multiply* involves its direct object. To understand its correct usage, let us consider two quantities a and b and the expression $a \times b$, representing their arithmetic product. There are several ways of describing this expression in English. The following are the most conventional.

(1) a multiplies b.
(2) b is multiplied by a.
(3) We multiply b by a.

Note that in the two active sentences, (1) and (3), "b" is the direct object of "multiply," and "a" is either the subject or the object of the preposition "by." Then, because (2) is the passive form of (1), "b" is the subject of this sentence.

Now, let us consider mistaken usage. Erroneous expressions used to describe the operation $a \times b$ usually take one of the forms below.

(4) a is multiplied to b.
(5) a multiplies to b.
(6) We multiply a to b.

These expressions all fail to describe the mathematical operation in question and are grammatically incorrect as well. It appears that the source of the confusion resulting in such problems is the misguided analogy to constructions involving the verb *add*: Note that we can describe the expression $a + b$ by the sentences *a is added to b* and *We add a to b*. (Other possible forms are *a and b are added* and *We add a and b*.)[2]

The following are further representative examples of the mistakes made using *multiply*.

[1] *Multiply* can also be used as an intransitive verb to mean 繁殖する or 増える. I do not consider this meaning here.

[2] For the sake of completeness, I list here the corresponding sentences for the other arithmetic operations: $a - b$ can be written *b is subtracted from a* or *We subtract b from a*, and $a \div b$ can be written *b divides a*, *a is divided by b* or *We divide a by b*.

(7) We multiply 2 on both sides.
(7) We multiply both sides by 2.
(8) By multiplying both sides of Eq. (2) with x^n, the desired result can be obtained by direct application of Lemma 2.
(8) Multiplying both sides of Eq. (2) by x^n, the desired result can be obtained by direct application of Lemma 2.
(9) This effect can be compensated by multiplying an overall factor to F.
(9) This effect can be compensated for by multiplying F by an overall factor.
(10) The Weyl weight is lowered by multiplying α^{-1} on each component field.
(10) The Weyl weight is lowered by applying a factor of α^{-1} to each component field.
(10*) The Weyl weight is lowered by multiplying each component field by a factor of α^{-1}.
(11) Here, we must multiply the warp factor corresponding to the mass dimension to the values in the bulk.
(11) Here, we must multiply the values in the bulk by the warp factor corresponding to the mass dimension.
(12) We can multiply an arbitrary element of $\hat{H}$ to the representative of the coset manifold from the right.
(12) We can multiply the representative of the coset manifold by an arbitrary element of $\hat{H}$ from the right.
(13) Multiplying $-1/\hat{G}_s^2$ to the RG equation yields the more familiar form.
(13) Multiplying the RG equation by $-1/\hat{G}_s^2$ yields the more familiar form.

Note that there is also a misuse of “compensated” in (9).

80.2 Mathematical problems

The verb *multiply* should not be used in reference to any mathematical operation other than multiplication (although, of course, the nature of the operation of multiplication depends on the mathematical system under investigation). For example, consider the following.

(1) We multiply the right-hand side by $\partial/\partial x$.
(1) We operate on the right-hand side with $\partial/\partial x$.
(1*) We apply $\partial/\partial x$ to the right-hand side.
(2) The transformation multiplying ϵ constitutes a map into $g(x)$.
(2) The transformation applied to ϵ constitutes a map into $g(x)$.
(3) This is done by first multiplying the right-hand side of (2.1) by $\int_{-\infty}^{\infty} dx$ and then taking the $t \to \infty$ limit.
(3) This is done by first integrating the right-hand side of (2.1) over x

from $-\infty$ to $+\infty$ and then taking the $t \to \infty$ limit.

Chapter 81

namely

The adverb *namely* is very often misused by Japanese authors.[1] In fact, in the papers that I read, it is almost always misused.

81.1 Introduction

In modern English, *namely* is used only to introduce a more concrete, explicit, specific or clear restatement of a previously appearing expression.[2] It can be used synonymously with certain senses of the terms *that is to say*, *that is*, *i.e.*, *in other words*, *which /is/are/happen to be/*, *more precisely* and *specifically*.

To begin our discussion, let us compare the sentences below.

(1) We consider the two values $\gamma = 0$ and $\gamma = 1$.
(2) We consider two values, $\gamma = 0$ and $\gamma = 1$.
(3) We consider two values, namely $\gamma = 0$ and $\gamma = 1$.

While these sentences are all similar in meaning, and in some cases could be used interchangeably, there are some important differences. Of these, (1) is the most neutral in meaning. It does not imply that there is a particular reason for considering two values, nor does it imply that there is no such reason. Also, it implies neither that the values $\gamma = 0$ and $\gamma = 1$ are special nor that they are not special. The second sentence seems to indicate that there may be some particular reason for considering two values, although this is by no means certain. Like the first sentence, it implies nothing about the specialness of the values 0 and 1. While (1) and (2) are very close in meaning, (3) differs significantly. Like (2), it appears to indicate that there is some reason for considering two values, but this meaning is somewhat stronger in this case. More importantly, however, in contrast to (1) and (2), it implies that

[1]Much of the mistaken use that I see apparently results from the direct translation of つまり or すなわち. It should be kept in mind that these Japanese words can be used in many types of situations in which *namely* would be inappropriate.

[2]Historically, *namely* has been used in a variety of other ways, and some of the misuse I see corresponds to some such outdated uses. For the purpose of the discussion given in this chapter, it is particularly important to note that the Oxford English Dictionary [4] and Webster's Revised Unabridged Dictionary [5] list the following meanings as obsolete: *particularly*, *in particular*, *especially* and *for example*.

the reader already has some information about the values $\gamma = 0$ and $\gamma = 1$ that distinguishes them from other values. Thus, while in (1) and (2) it seems that the values $\gamma = 0$ and $\gamma = 1$ were perhaps chosen arbitrarily, in (3) the connotation is that there was some reason for choosing these particular values and that the reader is (or should be) aware of this reason. This elucidates the most important point regarding the use of *namely*: In general, the implication expressed by this word is that the information following it is not entirely new to the reader. In the case of (3), because the statement "We consider two values" alone does not identify the particular values 0 and 1, this sentence would be appropriate only in the case that from the discussion leading up to this point, the reader gained knowledge about the special significance of $\gamma = 0$ and $\gamma = 1$. This sentence illustrates one typical use of *namely*. Another is demonstrated by (1) and (2) of the next section. In that usage too, *namely* is used to introduce information that is not entirely new. However, in that case, the background with which this information has been made known to the reader is not presented in previous discussion but, rather, in the sentence or clause immediately preceding *namely*. Thus in this second usage, the role of *namely* is to connect two clauses or sentences that communicate essentially the same information.

As described above, *namely* can play two types of roles. As I now discuss, it is also useful to distinguish between two types of meaning with which it can be used. With the first type of meaning, *namely* is used in the situation that the information it introduces is, from previously acquired knowledge, completely known (or knowable) to the reader. In this case, *namely* could be replaced by *that is*, *that is to say*, *i.e.* or *in other words*, although these are somewhat clearer in their implication of introducing a *restatement*. This type of meaning is illustrated in (1), (2) and (4) of the next section. With its second type of meaning, *namely* is used in the situation that although the general nature of the information it introduces can be surmised from previously acquired knowledge, the precise content of this information cannot be known from such knowledge alone. In this situation, *namely* could be replaced by such expressions as *specifically*, *which happen(s) to be* and *which we choose as* without changing the meaning significantly, although each of these does possess its own distinctive shade of meaning. Examples (3), (5) and (6) in the next section demonstrate use of *namely* with this meaning.

81.2 Proper use

Before examining misuses of *namely*, it is useful to consider its proper uses. These are illustrated by the following.

> (1) However, this condition is satisfied only for halogens with $a \geq 53$, namely iodine and astatine.
> (2) This feature is prominent only among the most highly organized species of Mollusca, namely those of the class Cephalopoda.
> (3) The players' actions have the most important effects on the state of the resources, namely, reduction of tree height through cutting and increase of tree number through planting.
> (4) In this case, however, the procedure cannot be applied in the manner

defined by Thomas – namely, by simply applying the permutation and integrating.
(5) These procedures can be applied in any order, with the only significant difference in results coming from the permutation of (i) and (ii). As representatives of the two corresponding cases, we investigated two orders in detail, namely (i), (ii), (iii), (iv) and (ii), (i), (iii), (iv).
(6) However, the analysis we introduce in the next section is fundamentally flawed, as it ignores a very basic principle of classical mechanics, namely energy conservation.

As seen in these examples, in general, *namely* is used in the situation that a vague or indirect statement is made more explicit or precise by an attached comment. In (1), the expression “halogens with $a \geq 53$” describes certain elements, while “iodine and astatine” identifies the same elements explicitly. The phrase “most highly...Mollusca” in (2) is a somewhat indirect and vague way of referring to species of the class Cephalopoda. In (3), the sentence introduced by “namely” unambiguously describes the effects referred to in the first sentence. The phrase “by simply applying...integrating” in (4) is equivalent in meaning to “the manner...Thomas,” and it serves simply to clarify this statement. In (5), the phrase introduced by “namely” explicitly identifies the actual “orders” considered. The clause “as it...mechanics” in (6) makes unspecific mention of a principle that is specified by “namely...conservation.” In these sentences, “namely” could be replaced by the following expressions (although in some cases, the resulting meaning would differ slightly): in (1), *that is to say*, *that is*, *i.e.*, *in other words*, *which are*; in (2), *that is to say*, *that is*, *i.e.*, *in other words*, *more precisely*, *specifically*; in (3), *specifically*; in (4) *that is to say*, *that is*, *i.e.*, *in other words*; in (5), *which are*, *specifically*, *which we chose as*; in (6), *specifically*.

There are two points to note concerning the above uses of “namely.” The first regards the special meaning expressed by the *[indirect expression] + namely + [direct expression]* structure as a whole,[3] and the second regards the special meaning implied by *namely* itself.

It is important to understand that the construction *[indirect expression] + namely + [direct expression]* expresses a particular type of emphasis, and when such an emphasis is not intended, it should not be used. Usually, this emphasis is that the meaning expressed by the indirect statement is of primary importance. Often, I find this construction used when an explicit expression alone would convey the intended meaning. This results in unnatural and usually misleading statements. To understand this, it is useful to study the types of special meaning conveyed by the use of this structure in the above examples. The statement in (1) is primarily about the stated condition, not about iodine and astatine. Here, apparently, the intention is to make an assertion regarding the severity of this condition. Also, the author clearly wishes to imply that it is most useful and/or most natural to think of this condition in terms of certain properties possessed by sufficiently heavy halogens. The identity of those elements that actually happen to satisfy this condition is of secondary

[3]Note that the same point applies to any construction of the form *[indirect expression] + [connector] + [direct expression]*, not just those for which this *[connector]* is *namely*.

importance. In (2), evidently the author wishes first to assert that the prominence of the "feature" in question is in some way related to the degree of anatomical organization of the species within the phylum Mollusca. The phrase introduced by "namely" is of secondary importance and acts simply to specify that by "most highly organized...," she is referring to the class Cephalopoda. Implicit is the meaning that within the present context, the author is considering species within this class to be special by virtue of their highly developed organization. The author of (3) seems to be primarily concerned with making it clear that the "players" have some effect on their environment. Describing the specific nature of this effect appears to be of secondary importance. In (4), the author apparently wishes to clearly specify that the "manner" of interest is that introduced by Thomas. In (5), the main point is that only the order of (i) and (ii) is important. The primary intention in (6) is to assert that the analysis is flawed, while identifying the root of this flaw is understood to be of secondary importance. Here it is important to note that if "is fundamentally flawed, as it" were removed, this use of "namely" would become unnatural, because the main point would no longer be the fact that the analysis is fundamentally flawed but, instead, that it ignores energy conservation.

Now, let us examine more closely the special meaning of *namely* mentioned in the previous section and how it is expressed in each of the above examples. *Namely* is used to introduce information of which the reader is already to some extent aware, either by virtue of previously acquired knowledge of the topic under consideration or through reasoning from the information given to this point in the present discussion. For this reason, in the correct use of the construction *[indirect expression] + namely + [direct expression]*, the indirect expression is sufficient to allow the reader to guess what the direct expression makes explicit, and thus this direct expression can be considered a parenthetic comment. In the situation that this is not true, *namely* cannot be used. In each of the above sentences, the indirect expression does indeed allow the reader to guess the information presented by the direct expression. This is clearly true in (1), as a basic knowledge of the periodic table is sufficient to realize that the phrase "halogens with $a \geq 53$" refers to iodine and astatine. Thus the information following "namely" appears simply to remind the readers of what they already do (or should) know. In this regard, (2) is quite similar. A somewhat more complicated situation is presented by (3). Here, it seems that the information introduced by "namely" is new, because apparently to this point in the paper the reader has not been told how the "players'" actions affect the environment. However, it is likely that the model has been described in enough detail that the reader would be able to guess how the players do this without being told explicitly. Indeed, this use of "namely" would be inappropriate if this were not the case. In the situation described by (4), it is apparent that with sufficient knowledge of the field under consideration, the reader will know that the "manner defined by Thomas" is that described by "simply...integrating." The phrase introduced by "namely" is simply added for the benefit of those readers who may not be so familiar with the field. In (5), although the actual orders of the procedures in question are not clear before their explicit mention, the important point in their regard – that the orders in which (i) and (ii) appear are opposite – is clear. Thus the pair of orders (i), (ii), (iii), (iv) and (ii), (i), (iii), (iv) is representative of the small set of possible pairs that has

been clearly identified prior to "namely." Although the information appearing before "namely" in (6) does not uniquely identify the basic principle that is ignored in the analysis under consideration, it does identify a small number of such principles with which the reader is certainly very familiar. Also, within the present discussion, the important point is simply that this analysis ignores some basic principle, not that this principle happens to be energy conservation. For this reason, the principles identified by the first clause are in some sense interchangeable.

81.3 Improper use

There are a number of ways in which *namely* is misused. Here I give some examples illustrating the most common of these.

81.3.1 Misused as a synonym of *specifically*

The misuse of *namely* that I most frequently encounter is that in which it is used as a synonym of *specifically* to introduce entirely new information. (As seen above, *namely* can sometimes be used as a synonym of *specifically*. However, it is more often the case that it cannot be used in this way.) This misuse is represented by the following.

> (1) We used two different values of c in our numerical computations, namely 0 and 1.
> (1) We used two different values of c in our numerical computations, 0 and 1.

Note that with regard to the use of "namely," (1) is essentially the same as (3) in Section 1. This use of "namely" implies that the information it introduces has in some sense been singled out as special before being presented here. Specifically, the connotation of (1) is that there is some particular reason for choosing the values 0 and 1 to use in the numerical computations. Thus, if no such special meaning is intended, this sentence will mislead the reader.

81.3.2 Misused as a synonym of *explicitly*

The example below is similar to (1), although here the meaning that the author intends to express with "namely" is closer to that of *explicitly* than that of *specifically*.

> (2) Experimental data indicate a set of relations between the Kobayashi-Masakawa matrix and the quark mass ratios, namely $|V_{us}| \sim \sqrt{m_d/m_s}$, $|V_{ub}/V_{cb}| \sim \sqrt{m_u/m_c}$ and $|V_{cb}| \sim m_s/m_b$.
> (2) Experimental data indicate the following relations between the Kobayashi-Masakawa matrix and the quark mass ratios: $|V_{us}| \sim \sqrt{m_d/m_s}$, $|V_{ub}/V_{cb}| \sim \sqrt{m_u/m_c}$ and $|V_{cb}| \sim m_s/m_b$.
> (2*) Experimental data indicate the relations $|V_{us}| \sim \sqrt{m_d/m_s}$, $|V_{ub}/V_{cb}| \sim \sqrt{m_u/m_c}$ and $|V_{cb}| \sim m_s/m_b$ between the Kobayashi-Masakawa matrix and the quark mass ratios.

In (2), the use of "namely" results in an apparently unintended meaning. The implication of this sentence seems to be one of two things: that the main intention of the author is to assert that the data indicate a set of relations between the Masakawa matrix and the quark mass ratios or that the reader should be able to guess these relations from the experimental data. However, the first interpretation is unlikely, because, considering the sentence as a whole, it appears that stating these relations explicitly is the most important point, while the second interpretation is even more unlikely, given the somewhat complicated nature of the relations.

81.3.3 Misused as a synonym of *in particular*

The expression *in particular* is used when we wish to narrow the scope of the discussion or to consider a specific situation or example. *Namely* cannot be used in the same manner.[4] This problematic usage is demonstrated below.

> (3) In this paper, we discuss the family structure of Ω, namely how the odd-odd and even-even elements are ordered. A determination of the entire family structure is left as a future problem.
> (3) In this paper, we discuss the family structure of Ω. In particular, we discuss the order of the odd-odd and even-even elements. A determination of the entire family structure is left as a future problem.

The use of "namely" in (3) implies that "how the odd-odd and even-even elements are ordered" is synonymous with "family structure" in the present context. However, it is clear from the last sentence that this order constitutes only a part of the family structure.

81.3.4 Misused to introduce an explanation

In general, it is inappropriate to use *namely* to introduce an explanation. Here I present typical examples of this type of misuse.

> (4) This could be most economically achieved as shown in Fig. 1; namely, we first introduce a Higgs field Φ^{-3} with $U(1)_X$ charge -3 and then proceed with a calculation analogous to that carried out above.
> (4) This could be most economically achieved as shown in Fig. 1: We first introduce a Higgs field Φ^{-3} with $U(1)_X$ charge -3 and then proceed with a calculation analogous to that carried out above.
> (4*) This could be most economically achieved as shown in Fig. 1, namely, by first introducing a Higgs field Φ^{-3} with $U(1)_X$ charge -3 and then proceeding with a calculation analogous to that carried out above.
> (5) There are two ways to obtain the desired result. Namely, we could first integrate over the index ξ and then treat the energy as fixed when solving for χ, or we could treat the energy as a free parameter in solving for χ and then integrate over ξ.

[4] *Namely* can be used synonymously with *specifically*, but not with *in particular*. (For a comparison of these two expressions, see Chapter 56.)

(5) There are two ways to obtain the desired result: We could first integrate over the index ξ and then treat the energy as fixed when solving for χ, or we could treat the energy as a free parameter in solving for χ and then integrate over ξ.

The difference between (4) and (4*) is that "by first...above" in (4*) is a restatement of "as shown in Fig. 1," while "we first...above" in (4) is not. A rewriting similar to (4*) is possible for (5) also, but in this case the result would be quite awkward.

81.3.5 Misused to introduce a description

The use of *namely* in situations like the following, where it introduces a description of something previously mentioned, is usually completely unnecessary and should be avoided.

(6) Suppose that γ_c, namely the critical value above which the structure becomes irregular, is in the convective regime.
(6) Suppose that γ_c, the critical value above which the structure becomes irregular, is in the convective regime.
(6*) Suppose that γ_c, /i.e./that is,/ the critical value above which the structure becomes irregular, is in the convective regime.
(7) Here we propose a method to solve this problem. Namely the ring system discussed above is used to determine the cosmological constant.
(7) Here, to solve this problem we propose a method in which the ring system discussed above is used to determine the cosmological constant.

81.3.6 Misused to express logical implication

Usually, *namely* cannot be used as a synonym of *therefore* or any other word that expresses a meaning of logical implication. The examples below demonstrate misuse of this kind.

(8) In this case, $a = 0$. Namely, by Theorem 1, $f \in G$.
(8) In this case, $a = 0$. Thus, by Theorem 1, $f \in G$.
(9) These n vectors are linearly independent. Namely, they span the n-dimensional space $\mathcal{S}$.
(9) These n vectors are linearly independent, and hence they span the n-dimensional space $\mathcal{S}$.

In these two examples, the first assertion logically implies the second. *Namely* is inappropriate in the role of expressing such a relation. It is important to note that here the assertion introduced by "namely" is *not* a restatement of the assertion preceding it.

81.3.7 Misused to express a causal relationship

Namely should never be used to introduce a sentence describing a situation or action whose cause is described in the previous sentence or sentences. Such expressions as

thereby, *in this way*, *as a result*, *as a consequence*, *consequently*, *in this manner*, *accordingly* and *thus* are appropriate in this situation. The following examples are typical.

> (10) Through this mechanism, there comes to appear a nontrivial phase structure corresponding to the size of the compactified space. Namely, the translational invariance in the compactified directions is broken spontaneously.
> (10) Through this mechanism, there comes to appear a nontrivial phase structure corresponding to the size of the compactified space, and /thereby/as a result/consequently/thus/ the translational invariance in the compactified directions is broken spontaneously.
> (11) The function $N(x, \theta)$ becomes discontinuous at $x = x_0 \approx 2.34$ when θ exceeds θ_c. Namely, Theorem 3, which requires the analyticity of N, no longer holds.
> (11) The function $N(x, \theta)$ becomes discontinuous at $x = x_0 \approx 2.34$ when θ exceeds θ_c. /As a result/Consequently/, Theorem 3, which requires the analyticity of N, no longer holds.
> (12) As the concentration of species a decreases in this region, the rate of the reaction producing species c decreases as $\sim e^{-a^{-1}}$. Namely, the luminosity of the sample, which is proportional to c^2, quickly drops below the threshold value l_0.
> (12) As the concentration of species a decreases in this region, the rate of the reaction producing species c decreases as $\sim e^{-a^{-1}}$. /As a result/Consequently/Accordingly/, the luminosity of the sample, which is proportional to c^2, quickly drops below the threshold value l_0.
> (13) As α is increased further, the system experiences a sequence of bifurcations through which it becomes unstable with respect to additional modes that appear through fluctuations and subsequently grow until stabilized by nonlinear terms. Namely, the system gradually comes to exhibit increasingly complex dynamics.
> (13) As α is increased further, the system experiences a sequence of bifurcations through which it becomes unstable with respect to additional modes that appear through fluctuations and subsequently grow until stabilized by nonlinear terms. /In this manner/In this way/Thus/As a result/Consequently/Accordingly/, the system gradually comes to exhibit increasingly complex dynamics.

In each of these examples, the first sentence describes some behavior that causes the result described in the second sentence. *Namely* cannot be used to connect such sentences.

81.3.8 Misused to introduce restatements of identical meaning

In the examples given here, the second statement consists of a mathematical expression that conveys exactly the same meaning as the first statement.

(14) The basin of attraction B_β of β has a positive ρ-measure, namely $\rho(B_\beta) > 0$.

(14) The basin of attraction B_β of β has a positive ρ-measure [i.e., $\rho(B_\beta) > 0$].

(15) The Cantor set contains the union of the sets of right endpoints C_r and left endpoints C_l of subintervals I_{ni} for every i and n. Namely, $C \supset C_r \ \cup \ C_l$.

(15) The Cantor set contains the union of the sets of right endpoints C_r and left endpoints C_l of subintervals I_{ni} for every i and n (that is, $C \supset C_r \ \cup \ C_l$).

The problem with each of the original sentences here is that the statement following "namely" has precisely the same meaning as the statement that proceeds it. Because these latter statements are in no way more explicit or explanatory than the statements they follow, "namely" should not be used.

Chapter 82

neglect vs. *ignore* and *omit*

The verb *neglect* is often misused in place of *ignore* and *omit*. Although these words are similar in meaning, and in some cases interchangeable, the main meaning of *neglect* is *make little consideration of*, while the main meaning of *ignore* is *make no consideration of* or *not to recognize* and that of *omit* is *leave out*.[1] Therefore, when the intended meaning is that something is not taken into consideration, removed from consideration, or in any sense simply treated as non-existent *neglect* should not be used. In almost all cases that I encounter *neglect* in the papers that I proofread, it is better replaced by *ignore*, *disregard*, *omit* or something synonymous.

The following typify the misuse of *neglect*.

> (1) As a first step toward such a truncated description, the evolution of the ghost action is neglected.
> (2) Hence, to neglect Y_k is justified as a first approximation.
> (3) In this equation, $\hat{\Gamma}_k$ is neglected.
> (4) These terms give no contribution to the quantities of interest in the present investigation, and therefore we neglect them.
> (5) Fluctuations of ϕ are neglected here.
> (6) The work involved in the operations of attaching and detaching the material to and from the heat baths has been neglected.
> (7) In this equation, the ellipsis denotes higher order terms, which we neglect in the present analysis.
> (8) In Eq. (9), the Pauli spin degrees of freedom are neglected.

In each of these sentences, judging from the situation under discussion, the intended meaning appears to be that the quantity or behavior in question is treated as non-existent. The use of "neglect," however, seems to imply that, rather than being completely removed from consideration, these things are just, in some way, partially removed from consideration. The following are some terms that could be used in place of "neglect(ed)" in the above: in (1), (5) and (6), *ignored* and *disregarded*; in (2) and (4), *ignore*, *disregard*, *remove* and *omit*; in (7) and (8), *ignore(ed)*, *disregard(ed)* and *omit(ted)*: In (3), the intended meaning seems to be that $\hat{\Gamma}_k$ is set to 0. If this is

[1] According to the Oxford English Dictionary [4], at one time *neglect* could be used with the meaning of *omit*, but this usage is obsolete.

indeed the case, then this expression would be better, because the sentence obtained by simply changing "neglected" to *ignored* or *omitted* is somewhat ambiguous.

The problem treated here seems to result from the misconception that ネグる is translated as *neglect*. In fact, normally ネグる corresponds to *ignore*.[2]

[2]For example, see 小学館プログレッシブ和英中辞典第二版 (1993).

Chapter 83

no more

83.1 Introductory discussion

When used as an adverb, the expression *no more* has two main meanings, that of *no longer* and that of *to no greater degree/extent*. However, because when used with the former meaning, *no more* carries a special implication, it is best in scientific writing to use it only with the latter meaning. I now discuss the reason for this.[1]

In most cases, *no longer* cannot be replaced by *no more*. The former is a set expression whose meaning is *not now as in the past*. Although *no more* can be used with this meaning, it is appropriate only in certain very special situations, usually with a connotation of death or some other kind of finality. For example, the following are possible.

(1) No more does my friend write.
(2) Jim is here no more.

These statements seem to imply that these people have died. They demonstrate the dramatic implication of the expression *no more*. In the above sentences, this is partly due to the positioning of "no more" at the beginning and end of the sentences. In fact, if we replaced "no more" with *no longer*, the resulting sentences would be similarly dramatic. However, this mood of dramatic finality expressed by *no more* is not entirely due to its position. This can be seen from the example below.

(3) This issue is no more of concern.

This sentence has a somewhat more dramatic feel than that obtained by replacing "no more" with *no longer*. The more important point in regard to the dramatic connotation of *no more*, however, is that in most cases when this word is used to express the meaning of *not now as in the past*, it can be used only at the beginning or end of a clause, and such a positioning greatly accentuates this connotation. To understand this, let us consider the following rewritten forms of the above sentences.

(1′) My friend no longer writes.
(2′) Jim no longer is here.

[1] An important point to note here is that, except in very special situations, *no more* should not be used to express the meaning of もう... しない.

These sentences lack the dramatic implication of the originals. Now, note that with these sentences rewritten in this way, *no more* cannot be used in place of "no longer," as the resulting sentences simply make no sense.

A somewhat different situation can be understood from the following.

(4) This reasoning is no longer valid.
(4′) This reasoning is no more valid.

In this case, although (4′) makes sense, its meaning is different from that of (4). Here, "no more" can only be interpreted as meaning *to no greater extent*. In order to use *no more* to express a meaning like that of (4), this would have to be written in one of the following manners.

(4″) This reasoning is valid no more.
(4‴) No more is this reasoning valid.

However, both of these sound quite dramatic.

83.2 Grammatical considerations

The situation regarding the use of *no more* can be understood more clearly if we examine its grammatical role. In grammatical terms, the problem involving *no more* discussed in this chapter is that because *more* itself can act as an adverb, when such an interpretation is grammatically possible, both confusing and unnatural sentences can result. This can be realized by considering the construction *[subject] + [to be verb] + no more + [adjective]*. The most natural interpretation of such a sentence is that "more" and *[adjective]* form a set and that "no" negates the meaning of this set.[2] Thus, in the sentence *The wire is no more hot*, "more" appears to act alone as an adverb, modifying "hot," and hence "no" is understood as modifying the combination "more hot." The implication is that this "wire" is no more hot (i.e. hot to no greater extent) than something else. The situation is much the same with the constructions *[subject] + [verb] + no more + [adverb]*, *[subject] + [to be verb] + no more + [adverb] + [adjective]* and *[subject] + [auxiliary verb] + no more + [adverb] + [main verb]*. Here, again, even if "no more" is meant to modify the verb (or auxiliary verb), the most natural interpretation is that "more" modifies *[adverb]*, and "no" negates the meaning of this set. Thus, in the sentences *These tones resonate no more loudly*, *The debt is no more rapidly increasing* and *I can no more easily solve these equations*, "more" appears to be modifying the adverbs "loudly," "rapidly" and "easily," and the resulting meanings are that "these tones" resonate no more loudly than some other tones, this "debt" increases no more rapidly than something else, and "I" can solve "these equations" no more easily than someone else. In each case here, "no more" could be used to clearly express the meaning of

[2]Note that (3) above is an exception to this rule. There, although "of concern" acts as an adjective, in the expression "no more of concern," "more" would not be understood as modifying "of concern," and hence "no more" would not be interpreted as meaning *to no greater extent*. The reason that this case is special is that if the intention were use *more* here to express the meaning of *to no greater extent*, this sentence would be written *This is of no more concern.*

not now as in the past by moving it to the end of the sentence, but in each case, the result would be a rather dramatic assertion. Next, consider the construction *[subject] + no more + [verb]*. Although the problem here is perhaps somewhat less clear than that involving the constructions given above, grammatically, the situation is similar. For example, in the sentence *He no more plays the guitar*, "more" could be interpreted as modifying the verb "plays." Indeed, this sentence leaves the reader with the impression that it is just the first half of something like *He no more plays the guitar than I play the piano*, and thus it does not appear to express a complete thought. Finally, consider the sentence *S is no more a parabola.* Here, unlike in the examples above, there is no possibility of misinterpreting "more" to be acting independently of "no" as an adverb, and thus the type of problem discussed above does not exist. However, this sentence has a more dramatic feel than *S is no longer a parabola*, and hence in most situations it would be inappropriate.[3]

83.3 Further examples

Below I give some typical examples of the misuse of *no more* that I encounter.

> (1) The singlet axial vector current is no more conserved.
> (2) The statistical distribution of E at the end of the adiabatic process is no more consistent with the canonical ensemble.
> (3) Once $\mathcal{E}$ begins to move toward a type-I fixed point, it can no more readily change its direction.
> (4) Therefore the center of mass of the system no more moves.
> (5) Once this occurs, $e^{\pm}$ are no more on-shell.

In each of these sentences, the intended meaning is obtained by replacing "no more" with *no longer*. The problem in (1)–(3) and (5) is that "no more," belying the author's intention, would be interpreted with the meaning of *with no greater degree* or *to no greater extent*. The use of "no more" in (4) simply does not make sense. The sentences obtained by moving "no more" to the final position – although unambiguously expressing the idea that the things in question are *not now as in the past* – are inappropriately dramatic.

[3]The difference between *no more* and *no longer* in regard to the point discussed here can be understood by considering the following. First, note that the sentences *This wire is more hot*, *These tones resonate more loudly*, *The debt is more rapidly increasing*, and *I can more easily solve these equations* (i.e., those obtained by simply deleting "no" in the above examples) are perfectly natural, and in each "more" clearly expresses the meaning of *to a greater extent.* Next, note that, by contrast, the sentences obtained by replacing "more" with *longer* here (*This wire is longer hot*, *These tones resonate longer loudly*, *The debt is longer rapidly increasing*, and *I can longer easily solve these equations*) are clearly nonsense.

Chapter 84

not only

Problems of sentence construction involving the expression *not only* appear very often in written work by Japanese scholars. These can cause a great deal of confusion.[1]

In most situations, *only* modifies the word (and sometimes the phrase or clause) appearing either directly before it or directly after it and expresses a limitation to the thing, action, state, case, etc., expressed by this word. For example, *Only an apple was eaten* and *That eaten was an apple only* imply a limitation on what was eaten to an apple alone, while *An apple was only eaten* and *An apple was eaten only* imply a limitation on the action carried out with respect to the apple to eating alone. (Note that *An apple only was eaten* could be interpreted with either meaning. In spoken English, the intended meaning of this sentence can be made clear by applying stress to the appropriate word.) While *not only* is obviously opposite in meaning to *only*, the situation regarding this grammatical point is similar. To understand this, let us consider the following examples, demonstrating the most common misuse of this expression.

> (1) Not only the number of degrees of freedom doubles, but the nature of the underlying symmetry changes completely.
> (1) Not only does the number of degrees of freedom double, but the nature of the underlying symmetry changes completely.
> (2) Not only this method allows for a simplified calculation, but also it yields more general results.
> (2) Not only does this method allow for a simplified calculation, but also it yields more general results.
> (3) Not only this assertion is imprecise, but interpreted strictly, it is not true.
> (3) Not only is this assertion imprecise, but interpreted strictly, it is not true.

In (1), the fact that "only" appears directly in front of "the number of degrees of freedom" implies that *something* is not limited to the degrees of freedom. More precisely, it expresses the meaning that there is something in addition to the number

[1] Most of the discussion given here can be applied to the synonymous expression *not just* as well. However, problems involving this expression appear less frequently, because use of this expression in general is less common.

of degrees of freedom that doubles (with the second clause describing a situation that is understood as being somehow in spite of this doubling). However, this is clearly not the intended meaning, which is expressed by (1). Here, the fact that "only" appears before the auxiliary verb "does" implies that it is being used with respect to the entire clause "does the number of degrees of freedom double." Thus the connotation is that *something* is not limited to the doubling of the number of degrees of freedom. This something is the changes experienced by the system. The first clause of (2) appears to imply that something is not limited to just "this method," and thus it would seem that this sentence regards multiple methods. The intended meaning, however, is that something about "this method" is not limited to the simplification of the calculation. This something is clearly the merits of the method. The first clause in (3) implies that the description "imprecise" is not limited to only "this assertion," and thus this sentence would be construed as concerning multiple assertions. The intended meaning, however, is that the flaws of "this assertion" are not limited to just its imprecision. This is expressed by (3).

Chapter 85

notation

In mathematical usage, the noun *notation* is used in reference to a set of conventions that define the meanings of symbols and symbolic expressions and, also, to the set of such symbols and symbolic expressions themselves. There are two main ways in which this word is misused.

85.1 Misused in plural form

Because *notation* refers to an entire **set** of symbols, it is a collective noun, and for this reason, it is almost never used in plural form. The following are representative of its misuse as a plural noun.

(1) Similar notations will be frequently used below.
(1) Similar notation is used frequently below.
(2) The following shows the relation between the two notations: $v_1 = a_2, v_2 = a_1, v_3 = a_3$.
(2) The two sets of quantities are related as follows: $v_1 = a_2, v_2 = a_1, v_3 = a_3$.
(3) The theoretical framework and notations follow those of Ref. [3].
(3) The theoretical framework and notation are the same as in Ref. [3].
(3*) We use the theoretical framework and notation of Ref. [3].
(4) We have changed the notations of the superpotential.
(4) We have changed the notation for the superpotential.
(5) The subscripts L and R in notations of Eq. (2.1)–(2.4) simply identify the relative spatial positions of the two wave packets.
(5) The subscripts L and R on the /functions/various quantities/ appearing in Eqs. (2.1)–(2.4) simply identify the relative spatial positions of the two wave packets.
(5*) The subscripts L and R in Eqs. (2.1)–(2.4) simply identify the relative spatial positions of the two wave packets.

85.2 Used with improper meaning

The term *notation* is very commonly misused in place of nouns like *terminology*, *expression*, *symbol*, *definition* and *quantity*. It should never be used in such roles. Two such examples are given in (3) and (5) of the previous section, where "notations" is apparently being used to mean something like *sets of quantities* and *quantities*, respectively. Below I present further examples.

(1) The notation C^* denotes this exotic charge.
(1) C^* represents this exotic charge.
(1*) In our notation, C^* represents this exotic charge.
(1**) The symbol C^* denotes the exotic charge.
(2) We use the notation $\tilde{A} = \int_0^\infty dx f(x)$.
(2) In our notation, $\tilde{A}$ is used to represent the quantity $\int_0^\infty dx f(x)$.
(2*) We use $\tilde{A}$ to represent the quantity $\int_0^\infty dx f(x)$.
(2**) We define $\tilde{A}$ as the quantity $\int_0^\infty dx f(x)$.
(2***) We make the definition $\tilde{A} \equiv \int_0^\infty dx f(x)$.
(2****) We write the quantity $\int_0^\infty dx f(x)$ as $\tilde{A}$.
(2*****) We denote the quantity $\int_0^\infty dx f(x)$ by $\tilde{A}$.
(3) Here, the notation $X(t_n)$ represents the value of X at the nth time step.
(3) Here, $X(t_n)$ represents the value of X at the nth time step.
(3*) Here, the quantity $X(t_n)$ is the value of X at the nth time step.
(4) Using the notation $a(t) = x(t) + iy(t)$ and $b(t) = x(t) - iy(t)$, we have $\langle a(t)^2 \rangle = \langle b(t)^2 \rangle = \theta(t)$.
(4) Writing $a(t) \equiv x(t) + iy(t)$ and $b(t) \equiv x(t) - iy(t)$, we have $\langle a(t)^2 \rangle = \langle b(t)^2 \rangle = \theta(t)$.
(4*) Defining the quantities $a(t)$ and $b(t)$ by $a(t) \equiv x(t) + iy(t)$ and $b(t) \equiv x(t) - iy(t)$, we have $\langle a(t)^2 \rangle = \langle b(t)^2 \rangle = \theta(t)$.
(5) For this purpose, we prepare some notation.
(5) For this purpose, we define some /terminology/useful quantities/.
(6) In this section, we use the notation W instead of $\widetilde{W}^{(\mu)}$.
(6) In this section, we write $\widetilde{W}^{(\mu)}$ as simply W.
(7) We now introduce a notation.
(7) We now give a definition.
(7*) We now introduce a useful quantity.
(8) Here we use the notation $\hat{\Delta} = i\hat{\sigma}_y$ for even parity and $\hat{\Delta} = i\hat{\sigma}_{-y}$ for odd parity.
(8) Here, we have $\hat{\Delta} = i\hat{\sigma}_y$ for even parity and $\hat{\Delta} = i\hat{\sigma}_{-y}$ for odd parity.
(8*) Here we define $\hat{\Delta}$ as $i\hat{\sigma}_y$ for even parity and $i\hat{\sigma}_{-y}$ for odd parity.
(8**) Here we use $\hat{\Delta}$ to represent $i\hat{\sigma}_y$ for even parity and $i\hat{\sigma}_{-y}$ for odd parity.
(9) In what follows we use the notation $m' = M_*^{-2}$.
(9) In what follows we use the definition $m' \equiv M_*^{-2}$.
(9*) In what follows we write M_*^{-2} as m'.
(10) We also use the notations $s' = s_1 - s_2$, $k' = k_1 - k_2$ and $z' = z_1 - z_2$.
(10) We also define the quantities $s' \equiv s_1 - s_2$, $k' \equiv k_1 - k_2$ and $z' \equiv$

$z_1 - z_2$.
(11) Hereafter the notation $x_{ij}^{\mu} \equiv x_i^{\mu} - x_j^{\mu}$ is used for simplicity.
(11) Hereafter, we employ the expression x_{ij}^{μ} in place of $x_i^{\mu} - x_j^{\mu}$ for simplicity.
(11*) Hereafter, we write $x_i^{\mu} - x_j^{\mu}$ as x_{ij}^{μ} for simplicity.
(11**) Hereafter, we denote the quantity $x_i^{\mu} - x_j^{\mu}$ by x_{ij}^{μ} for simplicity.
(12) The notation $\langle \cdots \rangle_N$ means that the average should be taken over all paths consisting of at least N steps.
(12) An expression $\langle \cdots \rangle_N$ represents an average taken over all paths consisting of at least N steps.

Chapter 86

nothing but

86.1 Incorrect use

The adjective *nothing but* is overused by Japanese authors.[1] In most situations that I find this expression used, it either adds nothing or imparts an inappropriate nuance. Particularly common is the misuse of *nothing but* with the *to be* verb. Usually, in such situations, nothing is needed in its place, but when some particular emphasis is desired, this can usually be appropriately expressed by something like *precisely*, *exactly*, *identically*, *identical to*, *equivalent to*, *equal to*, or *simply*.

Generally, *nothing but* carries with it the implication that the noun it modifies represents a thing that is in some sense insignificant or in some sense simple. In most cases that I see this expression used by Japanese authors, however, this is not the intended meaning. Let us consider an example.

(1) Thus, ρ^2 is nothing but γ in Eq. 1.
(1) Thus, ρ^2 is equal to γ in Eq. 1.
(1*) Thus, ρ^2 is precisely γ in Eq. 1.
(1**) Thus, ρ^2 is exactly γ in Eq. 1.
(1***) Thus, ρ^2 is identically γ in Eq. 1.
(1****) Thus, ρ^2 is identical to γ in Eq. 1.
(1*****) Thus, ρ^2 coincides with γ in Eq. 1.
(1******) Thus, ρ^2 is equivalent to γ in Eq. 1.
(1********) Thus, ρ^2 reduces to γ in Eq. 1.

The meaning of (1) is unclear. Its possible interpretations are clearly expressed by the various rewritten forms, each of which relates a somewhat different idea. In the simplest situation, and when there is no particular emphasis necessary, (1) is probably the best choice. In the case that the intended emphasis regards the numerical values of ρ^2 and γ, then (1*) is most suitable. If one wishes to express the meaning that ρ^2 and γ are mathematically the same quantity, then (1**), (1***) or (1****) can be used. In the case that ρ^2 and γ represent more complicated

[1] I believe this results from the direct translation of such Japanese constructions as ... 以外の何ものでもない and ... に他ならない. It should be noted that expressions of this kind are used much more often in Japanese than in English. Also, in fact, *nothing but* is closer in meaning to ... に過ぎない and ... だけ than to the above expressions.

mathematical objects (spaces, transformations, groups, etc.) and the intention is to state that they are the same, then (1^{***}) or (1^{****}) is the best choice. Example (1^{*****}) can be used as an alternative of (1^{*}), (1^{**}), (1^{***}) or (1^{****}). If the purpose is to assert that in the present context ρ^2 and γ do or can play the same role, then (1^{******}) is the most fitting. Finally, if the intended meaning is that this is a special case in which the more general form of ρ^2 reduces to that of γ, then ($1^{*******}$) is appropriate.

Now let us study some slightly different examples.

(2) This is nothing but the condensation effect.
(2) This is the condensation effect.
(2^{*}) This is /precisely/identically/ the condensation effect.
(2^{**}) This is equivalent to the condensation effect.
(2^{***}) This is simply the condensation effect.
(3) This is nothing but the quantity required by the Riemann-Roch theorem.
(3) This is /precisely/exactly/identically/ the quantity required by the Riemann-Roch theorem.
(4) In this case, the heat transferred to the system is nothing but the microscopic work done by the frictional force.
(4) In this case, the heat transferred to the system is /equal/identical/ to the microscopic work done by the frictional force.
(4^{*}) In this case, the heat transferred to the system is simply the microscopic work done by the frictional force.
(4^{**}) In this case, the heat transferred to the system reduces to the microscopic work done by the frictional force.
(5) The beginning of the decompactification is nothing but the Big Bang.
(5) The beginning of the decompactification /corresponds to/represents/ the Big Bang.
(5^{*}) The beginning of the decompactification constitutes the Big Bang.
(5^{**}) The beginning of the decompactification /corresponds to/represents/ the Big Bang itself.
(6) In the context of partonic studies, it is nothing but the DGLAP equation.
(6) In the context of partonic studies, it is referred to as the DGLAP equation.
(7) The condition (1.4) is nothing but the assumption (A3).
(7) The condition (1.4) is /identical to/equivalent to/the same as/ the assumption (A3).
(7^{*}) The condition (1.4) is simply the assumption (A3).
(7^{**}) The condition (1.4) reduces to the assumption (A3).

The meaning of (2) is unclear. The rewritten forms express its possible interpretations: (2) simply identifies the effect in question as the "condensation effect"; (2^{*}) is appropriate as a statement of mathematical equality or identity; (2^{**}) implies that these two effects have the same result presently (although in some other context they may have different results); (2^{***}) asserts that the effect in question

can be understood as the condensation effect and that this understanding is in some sense simpler than a previous understanding. The intended meaning in each of the remaining examples is somewhat more clear. In (3) this seems to be that we have found “precisely,” “exactly” or “identically” what we need. In (4), apparently the author either intended no special emphasis in stating the equality of these two quantities or intended to imply that the equality of the heat transferred and the work done by friction represents a simple situation. It also seems possible that the author wished to imply that the present simple situation is something to which the more complicated general situation has reduced. These three meanings are expressed by (4), (4*) and (4**). The difference between (5) and (5*) is point of view. The use of “corresponds to” and “represents” in (5) indicates that the “decompactification” is being considered a theoretical phenomenon, i.e., one existing within the model. By contrast, “constitutes” in (5*) implies that this is being considered a physical phenomenon. The intention of (6) is simply to point out that the equation in question has a particular name in a particular context. Obviously “nothing but” is quite inappropriate here. There seem to be three possible interpretations of (7). The first is that the author wishes merely to express the identity of “(1.4)” and “(A.3),” the second is that this identity is regarded as in some sense representing a simple situation, and the third is that the general situation has reduced to this simple situation in the present case. These meanings are expressed by the rewritten versions.

86.2 Correct use

The primary meaning of *nothing but* is essentially the same as the meaning shared by *only*, *merely*, *just* and *nothing more than*. Thus, for example, it is quite natural in the usage below.

(1) This reaction produces nothing but water.

Here, the intention is to express the idea that the product of this reaction is uninteresting because of its simplicity. There is also an implication that this may not have been expected or that the fact that this reaction produces only water is for some reason worthy of emphasis. (If we change “nothing but,” to *only*, the resulting sentence lacks such an implication.) The following also demonstrates a typical use of *nothing but*.

(2) However, this is nothing but illusion.

In this case, “nothing but” expresses the meaning that “this” is insignificant. This sentence has a kind of dramatic feel which somehow conveys the idea that it is disappointing to realize that “this” is actually an illusion.

Chapter 87

notion

The noun *notion* is overused and quite often misused by Japanese authors. In most situations, it is best to avoid using this word in place of the similar words *idea*, *thought*, *concept* and *conception.*[1] In particular, I find *notion* misused very often when the most appropriate choice would be *concept*. The difference between these words is that *notion* normally refers to a vague and perhaps poorly defined idea,[2] while *concept* refers to something that is usually clearly defined and probably well thought-out. For example, the expressions *the notion of and electron* and *the notion of a Lie group* would be inappropriate in most situations, while *the concept of an electron* and *the concept of a Lie group* are quite natural. The reason for this difference is that (in normal contexts) the terms *electron* and *Lie group* refer to well-defined ideas. Note, however, that *notion* is appropriate in the following: *When the notion of what was to eventually become the theory of Lie groups first occurred to Lie...* Here, "notion" is being used in reference to the still poorly-defined idea that Lie eventually formalized into a theory.

Below I give some examples typifying the misuse of *notion*.

> (1) We can introduce the notion of the a-level set of ψ for every $a \in (\inf \psi, \infty)$.
> (1) We can introduce the /concept/construct/ of the a-level set of ψ for every $a \in (\inf \psi, \infty)$.
> (2) The fundamental notion used here is the directional derivative $v(\varphi)$ of an affine function F.
> (2) The fundamental /concept/method/ used here is that of the directional derivative $v(\varphi)$ of an affine function F.
> (2*) The fundamental /mathematical tool/operation/ used here is the directional derivative $v(\varphi)$ of an affine function F.
> (3) The notion of v and w being almost parallel is justified in case (i).
> (3) The condition that v and w are almost parallel holds in case (i).
> (4) A key notion is the discontinuity of the crack front.

[1] Here, it should be noted that in most situations, *notion* is not appropriate to express the meaning of 概念.

[2] As stated in The American Heritage Dictionary of the English Language [1], "*notion* often refers to a vague, general, or even fanciful idea."

(4) A key /concept/condition/property/ is the discontinuity of the crack front.
(5) In this case, the notion of the exciton as a quasi particle loses its meaning.
(5) In this case, the /concept/idea/theoretical construct/treatment/ interpretation/ of the exciton as a quasi-particle loses its meaning.
(6) In this limit, using the notion of the absolute dominance, we can systematically expand a cross section in powers of g^{-1} and extract the leading contributions.
(6) In this limit, using the /idea of/means for comparison provided by/approach based on/ the absolute dominance, we can systematically expand a cross section in powers of g^{-1} and extract the leading contributions.
(7) The notion of our model is the following.
(7) The /basic idea of/manner of thinking behind/fundamental concept underlying/ our model is the following.
(7*) The /philosophy/understanding/theoretical viewpoint/ on which our model is based is the following.
(7**) Our model is summarized as follows.
(8) It is interesting to compare these aspects of brain activity to the notion of dynamic equilibrium.
(8) It is interesting to compare these aspects of brain activity to the /general physical phenomenon/theoretical concept/mathematical phenomenon/ of dynamic equilibrium.
(9) We consider the notion of matching the temperatures of the various systems.
(9) We consider matching the temperatures of the various systems.
(10) In this case the notion of temperature is still useful.
(10) In this case the concept of temperature is still useful.
(10*) In this case the temperature is still a useful physical parameter.
(11) Figure 2 demonstrates the notion of the inequality $\Sigma_\alpha(z) < H_1(z)$.
(11) Figure 2 illustrates the /idea of/idea behind/situation described by/implication of/ the inequality $\Sigma_\alpha(z) < H_1(z)$.
(12) Here, $\sigma(x)$ becomes constant, and the notion of space is lost.
(12) Here, $\sigma(x)$ becomes constant, and the concept of space loses its meaning.
(13) The notion of multi-scaling has been successfully employed in the characterization of complex spatio-temporal behavior.
(13) The /method/concept/ of multi-scaling has been successfully employed in the characterization of complex spatio-temporal behavior.
(14) The notion of an m-simple branched cover is a natural generalization of a simple branched cover.
(14) An m-simple branched cover is a natural generalization of a simple branched cover.
(15) However, the pinch singularity is a notion in momentum space.
(15) However, the pinch singularity is a construct in momentum space.

(15*) However, the pinch singularity is /something that exists/a phenomenon/ in momentum space.

Chapter 88

nowadays

The term *nowadays* is usually not suited to scientific and mathematical discussion. Although this word can be used as a synonym of *the present time* (as a noun) and *at the present time* (as an adverb), which simply refer to a *time*, it carries a stronger meaning of *these present times* (as a noun) and *in these days*, *in these times* or *during the present times* (as an adverb), which refer more to the *situation* that exists at the present time than to the present time itself. For this reason, *nowadays* fits better in discussions of social phenomena, and in particular fashion and trends. It can often be interpreted with a meaning like *present trends are such that* or *in the current fashion*. When such a meaning is not intended, one should avoid *nowadays* in favor of such expressions as *now*, *today*, *at the present time*, *at this time*, *presently* and *currently*, which have no implication of fashion. The following is a typical misuse of this word.

> (1) Nowadays, meson fields are regarded as bound states of quarks and anti-quarks represented by gauge invariant states.
> (1) Currently, meson fields are regarded as bound states of quarks and anti-quarks represented by gauge invariant states.
> (1*) Today, meson fields are regarded as bound states of quarks and anti-quarks represented by gauge invariant states.
> (1**) In the presently accepted theory, meson fields are regarded as bound states of quarks and anti-quarks represented by gauge invariant states.

In the original, it seems that the author's intention is to suggest that it is currently fashionable to regard meson fields as bound states of quarks and anti-quarks in the stated way, with the connotation that this fashion may lack a scientific basis. For this reason, this sentence seems to be meant as a criticism of the mainstream way of thinking. While it is possible that this is indeed the desired meaning, it is more likely that the author's intention is expressed by one of the rewritten versions. Here, (1) and (1**) are similar in meaning and stress that this statement is based on the best theory currently available. Whereas (1*) seems to emphasize the idea that in previous times, meson fields were not regarded as such bound states, (1) and (1**) have no such emphasis.

Below I present similar examples.

(2) Nowadays one of the most promising approaches to the construction of a theory of quantum gravity is string theory.
(2) /Currently/Presently/, one of the most promising approaches to the construction of a theory of quantum gravity is string theory.
(2*) Among presently considered approaches to the construction of a theory of quantum gravity, string theory is among the most promising.
(3) Nowadays, the analysis of tangent spaces has become a standard technique in the study of chaos.
(3) The analysis of tangent spaces has become a standard technique in the study of chaos.
(3*) The analysis of tangent spaces is now a standard technique in the study of chaos.
(4) Nowadays these are considered to be confined in the hadrons.
(4) In the currently accepted theory, these are considered to be confined in the hadrons.
(4*) In the most successful existing theory, these are considered to be confined in the hadrons.
(4**) Experimental evidence suggests that these are confined in the hadrons.
(5) These charge distributions can be measured precisely nowadays by electron scattering.
(5) These charge distributions can now be measured precisely by electron scattering.
(5*) These charge distributions can be measured precisely by modern electron scattering techniques.
(6) Nowadays polarized ion sources are commonly used in nuclear physics.
(6) Polarized ion sources are now commonly used in nuclear physics.
(6*) Polarized ion sources are commonly used in modern day nuclear physics experiments.

Of course, even in scientific works there is sometimes discussion of fashion and trend. The following is an example of a natural use of *nowadays*.

(7) Nowadays, the path-integral approach has become so fashionable that many physicists ignore all other possible approaches from the outset.

Here, in contrast to the previous examples, the author's intention is obviously to criticize a certain fashion.

Chapter 89

on the basis

Expressions of the form *on the basis of...* are greatly overused and often misused by Japanese authors.[1] This phrase means *with...providing /grounds/justification/ for* or *in accordance with...* In general it is used to modify a verb.[2]

89.1 Proper use

The following demonstrates the proper use of *on the basis*.

> (1) We conclude on the basis of these results that m_1 is neither the largest nor the smallest element of S_m.

Here, "on the basis of these results" clarifies the manner in which we arrive at the stated conclusion.[3] The implication is that "these results" allow such a conclusion to be drawn. The uses demonstrated below are also possible.

> (2) We constructed a new theory on the basis of the experimental findings presented in Ref. [2].
> (3) On the basis of this reasoning, we identify the first of these solutions with the behavior observed experimentally.
> (4) Ultimately, the validity of these results rests on the basis of the dimensional analysis given in the previous section.

In (2), the implication is that the experimental findings provide the grounds for construction of the new theory (in a sense, motivating or justifying this construction) and that the theory is constructed to be in accordance with these findings. It is important to note here that the prepositional phrase "on the basis of these experimental findings" modifies the verb "constructed," not the noun "theory." Similarly, the implication of (3) is that "this reasoning" provides the grounds or justification for making this "identification." Here, "on the basis of this reasoning" modifies "identify." The meaning of (4) is that the validity (or invalidity) of the "results" follows

[1] Grammatically, this is a prepositional phrase. Here, "on" is a preposition, and "basis" is its object.

[2] Hence it is an adverbial. The expression *on the basis of...* should be compared with *based on...*, which acts as an adjective (see Chapter 25).

[3] Here, the prepositional phrase "on the basis of these results" modifies the verb "conclude."

from that of the dimensional analysis. In this case, "on the basis of the dimensional analysis" modifies "rests."

89.2 Improper use

The phrase *on the basis of* is most often misused in two types of situations, one in which the intended meaning is something like *in terms of*, *in reference to* or *with respect to* and one in which it is something like *using*. The following demonstrate typical ways in which *on the basis* is misused.[4]

(1) These results are discussed on the basis of the Skyrme model.
(1) These results are interpreted in terms of the Skyrme model.
(1*) These results are interpreted using the Skyrme model.
(1**) These results are elucidated through consideration of the Skyrme model.
(1***) These results are discussed in terms of the Skyrme model.
(1****) These results are discussed in reference to the Skyrme model.
(1*****) These results are discussed in the context of the Skyrme model.
(1******) These results are analyzed using the Skyrme model.
(2) We have introduced a new theory on the basis of the conventional FQR theory.
(2) We have introduced a new theory based on the conventional FQR theory.
(3) In this paper, we examine this point on the basis of the Pitmann-Bolden theory.
(3) In this paper, we examine this point using the Pitmann-Bolden theory.
(3*) In this paper, we examine this point in reference to the Pitmann-Bolden theory.
(3**) The examination of this point given in the present paper is based on the Pitmann-Bolden theory.
(4) Similar studies have appeared on the basis of numerical models.
(4) Similar studies based on numerical models have appeared.
(5) The probability of two consecutive such events is ~ 0.02 on the basis of the cascade model.
(5) The probability of two consecutive such events is ~ 0.02, as calculated using the cascade model.
(5*) According to the cascade model, the probability of two consecutive such events is ~ 0.02.
(5**) Employing the cascade model, we calculate the probability of two

[4] In many of the examples considered here, *on the basis of...* is misused in what appears to be a direct translation of ... に基づいて or ... を踏まえて. While often *on the basis of...* can be used in this way, generally, it describes a more strictly defined logical relation than do ... に基づいて and ... を踏まえて, and hence the manner in which it can be used is more limited. Also, in some of the examples here, it seems that the author attempted to use *on the basis of...* in a role closer to that of ... に基づいている or ... に基づく. There are essentially no situations in which such use is appropriate.

consecutive such events to be ~ 0.02.

(6) It is found that, on the basis of results for the three statistical coefficients, this simple Langevin-type model is incapable of describing the behavior of actual neurons.

(6) On the basis of results for the three statistical coefficients, it is found that this simple Langevin-type model is incapable of describing the behavior of actual neurons.

(7) Let us rearrange these sets of numerical data on the basis of a different measure.

(7) Let us rearrange these sets of numerical data with respect to a different measure.

(7*) Let us rearrange these sets of numerical data in reference to a different measure.

(8) However, such a case was rejected previously in an examination on the basis of the coefficient of variation Q.

(8) However, such a case was rejected previously in an examination of the coefficient of variation Q.

(8*) However, such a case was rejected previously in an examination /employing/based on/concerning/ the coefficient of variation Q.

(8**) However, such a case was previously rejected on the basis of an examination of the coefficient of variation Q.

Below I briefly explain the problem with each of these sentences.

Example (1) would lead the reader to think that the discussion itself (rather than its conclusions) is justified by or facilitated by the Skyrme model. This is clearly not the intended meaning. As the rewritten versions indicate, there appear to be a number of possible interpretations of the original, but the main point of each is that the interpretation, elucidation, discussion or analysis of the results is carried out in consideration of or by use of the Skyrme model.

The implication of (2) seems to be that the justification or reason for introducing a new theory comes from the conventional FQR theory. However, as expressed by (2), the intended meaning is that the content of the new theory has its basis in the conventional FQR theory. (Note that "on the basis..." in (2) modifies "introduced," while "based on..." in (2) modifies "theory.")

From (3), it would be surmised that the cited theory provides grounds to justify or motivate the stated examination itself. In fact, however, it only provides a tool used in this examination.

It is suggested by (4) that the reason for the the studies mentioned here is offered by the numerical models and that the manner in which they have appeared is in accordance with these models. (Note that "on the basis of..." modifies "appeared," while "based on..." modifies "studies.")

The intended meaning of (5) is apparently that the probability of ~ 0.02 is calculated using the cascade model. This meaning is expressed by each of the rewritten forms. In the original, "on the basis..." modifies "is," and the resulting assertion is that it is a **fact** that the value of this probability is ~ 0.02, and this **fact** results

from the cascade model.

The problem with (6) is that although "on the basis..." is meant to modify the verb of the main clause, "found," because this phrase appears in the dependent clause ("that...neurons"),[5] it ends up modifying the verb of that clause, "is."

Of the examples appearing here, (7) is least problematic. In this case, "on the basis" is simply not the most suitable expression.

In (8), "on the basis..." can only be construed as modifying the noun "examination." This, however, is grammatically incorrect, as this expression is an adverbial.

Below I give a number of additional examples demonstrating the misuse of *on the basis* without comment.

> (9) These apparently new anomalies are explained on the basis of several well-known anomalies.
> (9) These apparently new anomalies are explained in terms of several well-known anomalies.
> (9*) These apparently new anomalies are shown to /result from/arise from/be due to/ several well-known anomalies.
> (9**) We show that these apparently new anomalies can be understood in terms of several well-known anomalies.
> (10) On the basis of the brane picture we explore new types of the coupling unification not described by perturbative string theories.
> (10) Employing the brane picture, we explore new types of the coupling unification not described by perturbative string theories.
> (10*) Basing our analysis on the brane picture, we explore new types of the coupling unification not described by perturbative string theories.
> (10**) Within the brane picture, we explore new types of the coupling unification not described by perturbative string theories.
> (11) In order to construct a realistic scenario, we first need to solve these three problems on the basis of the model introduced here.
> (11) In order to construct a realistic scenario, we first need to solve these three problems /using/by applying/within/ the model introduced here.
> (12) On the basis of simultaneous measurements we discuss the relationship between T_g and the dynamics of the α process.
> (12) Using the results of simultaneous measurements, we investigate the relationship between T_g and the dynamics of the α process.
> (13) On the basis of this model, two different processes of this kind should exist.
> (13) According to this model, two different processes of this kind should exist.
> (13*) This model predicts that two different processes of this kind exist.
> (14) The long time behavior of this equation is determined on the basis of the quantity D/ba^2.
> (14) The long time behavior of this equation is determined by the quantity D/ba^2.
> (14*) The long time behavior of this equation is essentially determined

[5] This is a noun clause.

by the quantity D/ba^2.
(15) This leads us to believe that the exponentially decaying velocity profile can be reproduced on the basis of a void creation process.
(15) This leads us to believe that the exponentially decaying velocity profile can be /attributed to/accounted for by/ a void creation process.
(15*) This leads us to believe that the exponentially decaying velocity profile can be /described in terms of/understood as/modeled using/ a void creation process.
(16) This formulation is on the basis of Ito calculus.
(16) This formulation is based on Ito calculus.
(17) This paper describes a perturbative framework on the basis of the closed-time-path formalism.
(17) This paper describes a perturbative framework based on the closed-time-path formalism.
(18) This theory can be expressed on the basis of such transformations.
(18) This theory can be expressed in terms of such transformations.
(18*) This theory can be reduced to such transformations.

Chapter 90

on the contrary

The prepositional phrase *on the contrary* is used very often in the papers that I proofread, and it is almost always used incorrectly.[1]

90.1 Correct use

In this section I describe the correct use of *on the contrary* in written English. More specifically, I treat only writing presented from a single point of view. Thus I do not consider the following type of (correct) conversational use.

> A: It seems you are very tired.
> B: On the contrary, I'm feeling full of energy.

90.1.1 First form: emphasis

The expression *on the contrary* can be used in only one particular type of logical construction. This logical construction appears in two forms. The first is illustrated by the following.

> (1) Today is not cold. On the contrary, this is the warmest day thus far this spring.

Note that the two statements "today is not cold" and "this is the warmest day thus far this spring" are consistent and close in meaning. This is the point most often missed by Japanese authors: The expression *on the contrary* connects similar and consistent assertions about the same thing. In the papers I read, this expression is used almost exclusively to connect contrasting statements about two different things. This usage is erroneous. The second point to note here is that the first sentence in (1) is negative ("...is not..."), while the sentence introduced by "on the contrary" is affirmative. This is generally the case when this expression is used in the first form, considered here. Finally, note that the assertion of the sentence introduced by "on the contrary" contradicts in an emphatic manner the **opposite** of the assertion of

[1] The expression *to the contrary* is essentially synonymous with *on the contrary*, and all the discussion given in this chapter applies to it too.

the first sentence.[2] (Compare *today is cold* with "this is the warmest day thus far this spring.") This is also generally the case when *on the contrary* is used in the presently studied first form.

The sentences below further demonstrate the proper use of *on the contrary* in the form we now consider.

> (2) This interaction does not lower the energy of the system. On the contrary, it increases the energy by such a large amount that the approximation used above becomes invalid.
> (3) These three conditions are not necessarily incompatible. On the contrary, in most cases they are equivalent.

Note that the three conditions mentioned above – that *on the contrary* connects similar and consistent statements about the same thing, that the first sentence is negative and the second sentence is affirmative, and that the second sentence emphatically contradicts the opposite of the assertion in the first sentence – are satisfied in these two examples.

Let us summarize the above discussion. From the examples (1)–(3), it is seen that when used in the form examined here, *on the contrary* connects two similar statements. These can be thought of as a 'main' statement and an 'auxiliary' statement. The auxiliary statement is introduced by *on the contrary*, and it serves to emphasize the assertion of the main statement. It does this by emphatically contradicting the **opposite** of this main statement.

90.1.2 Second form: contradiction

As stated above, *on the contrary* can be used in only one type of logical construction, which appears in two different forms. We now consider the second form. This is demonstrated by the following sentences.

> (4) It may be thought that the last term can be ignored. On the contrary, this is the most important term in determining the long-time behavior.
> (5) A linear analysis would lead us to believe that the first solution has the largest propagation velocity. On the contrary, a full analysis reveals that this is the slowest solution.
> (6) It is widely believed that these approaches are equivalent. On the contrary, in most cases of interest, they all produce significantly different results.

In each of these examples, in contrast to those given above, the sentence introduced by "on the contrary" in some sense contradicts the first sentence. Thus these examples appear to represent a logical construction that differs from that described

[2] The adjective *contrary* indicates an opposition or contradiction, and this, in fact, is the basic meaning expressed by *on the contrary*. Thus, while the role of this expression in the presently considered case is emphasis, it carries out this role through contradiction. It is important here to note the difference between *contradiction* and *contrast* and to keep in mind that *on the contrary* is used only to express contradiction. Thus, for example, it cannot be used in statements contrasting two distinct things, because such statements, in general, cannot be contradictory.

above. In fact, however, this is not true. To see this, let us look closely at the first sentence in (4). The use of the potential verb form "may be thought" implies that the statement appearing here, "the last term can be ignored," is false. Thus, logically, there is an implied assertion between these two sentences. Writing this explicitly, we have something like the following.

> (4′) It may be thought that the last term can be ignored. However, in fact it cannot be ignored. On the contrary, this is the most important term in determining the long-time behavior.

The situation is similar in (5), where the potential verb form is "would lead." In (6), the phrase "it is widely believed" plays the same logical role as the potential verb forms in (4) and (5), yielding the connotation that the assertion "these approaches are equivalent" is false.

We thus see that while the explicit forms of (4)–(6) are quite different from those of (1)–(3), the logical constructions are the same: The auxiliary statement introduced by "on the contrary" emphasizes the main (but in this case implied) statement, and it does this by emphatically contradicting its opposite.

90.2 Incorrect use

As discussed above, *on the contrary* is used to connect two consistent and similar statements (one of which may be implicit) about the **same thing**. The incorrect examples appearing below demonstrate the manner in which I almost always find this expression used by Japanese authors[3] – to connect contrasting statements about two **different things**. In most of these cases, the intended meaning can be correctly expressed by *contrastingly*, *contrastively*, *in contrast*, *by contrast*, *while*, *although*, *but*, *however*, *unlike* or *on the other hand*.

> (1) Anderson investigated the full system in the weak-coupling limit. On the contrary, we consider the simplified system described by (1) and study it in the strong-coupling limit.
> (2) This equation can be easily solved. On the contrary, that derived in Sect. 1 can only be treated numerically.
> (3) Bose-Einstein statistics describe integer spin particles. On the contrary, the particles in which we are interested are always of half-integer spin.
> (4) In the case discussed above, $t_0 > t_1$. On the contrary, in the present case, $t_0 < t_1$.
> (5) The primitive form of analysis used in the previous section does not allow us to draw any definite conclusions with regard to properties of this

[3]The misuses considered here seem to result from the mistaken translation of 反対に, ... に反して, ... に対して, 逆に and, in some cases, 対照的に as *on the contrary*. Although sometimes 反対に, ... に反して, ... に対して, 逆に and similar expressions indeed can be translated as *on the contrary*, when they are used to express only a meaning of contrast (対照), this is inappropriate. Also, it is never possible to translate 対照的に as *on the contrary*. In general, *on the contrary* carries a meaning of opposition (対立, 不両立, 矛盾), not contrast.

solution. On the contrary, with the form of analysis developed in this section we are able to determine upper bounds on the values it assumes in each of the intervals in question.

(6) The broadening of the distribution of relaxation times for the α-process causes $T_{\rm g}$ to decrease. Figure 4(a) shows, on the contrary, that T_α remains almost constant.

(7) There is a general calculational procedure to determine the tunneling rate through a static potential using the complex-time path integral method. On the contrary, there is no such procedure for time-dependent potentials.

(8) If there is no energy exchange among the normal modes, the relation $\eta(t) = 1$ continues to hold. On the contrary, $\eta(t)$ decreases if energy exchange occurs.

(9) On the contrary to a naive summation, a careful treatment shows that we need a single mass insertion in each n-point function of the ϕ^3 scalar field theory.

(10) On the contrary to the result for $d = 1.9$, for $d = 2.5$ there is a positive coupling region.

(11) For $N = 2$, the system is unchanged under the transformation $g \leftrightarrow -g$. On the contrary, for $N \geq 3$, there is no such a symmetry.

(12) This effect is strongly enhanced by the increase in γ that occurs in the limit that $\overline{\varphi}$ approaches 1. On the contrary, it is strongly impaired by the increase in the number of defects that appear in the same limit.

Clearly, none of these examples possesses the kind of logical structure necessary for the use of *on the contrary*.

Below I present some possible corrected versions of the above examples.

(1) Anderson investigated the full system in the weak-coupling limit, while we consider the simplified system described by (1) and study it in the strong-coupling limit.

(2) This equation can be easily solved. Contrastingly, that derived in Sect. 1 can only be treated numerically.

(3) Bose-Einstein statistics describe integer spin particles, but the particles in which we are interested are always of half-integer spin.

(4) In the case discussed above, $t_0 > t_1$. However, in the present case, $t_0 < t_1$.

(5) The primitive form of analysis used in the previous section does not allow us to draw any definite conclusions with regard to properties of this solution. Contrastingly, with the form of analysis developed in this section we are able to determine upper bounds on the values it assumes in each of the intervals in question.

(6) The broadening of the distribution of relaxation times for the α-process causes $T_{\rm g}$ to decrease. Figure 4(a) shows, by contrast, that T_α remains almost constant.

(7) There is a general calculational procedure to determine the tunneling rate through a static potential using the complex-time path integral

method. For time-dependent potentials, however, there is no such procedure.

(8) If there is no energy exchange among the normal modes, the relation $\eta(t) = 1$ continues to hold, but if energy exchange occurs, $\eta(t)$ decreases.

(9) In contrast to the treatment employing a naive summation, a careful treatment shows that we need a single mass insertion in each n-point function of the ϕ^3 scalar field theory.

(10) Unlike the result for $d = 1.9$, the result for $d = 2.5$ shows that there is a positive coupling region.

(11) For $N = 2$, the system is unchanged under the transformation $g \leftrightarrow -g$, but for $N \geq 3$, there is no such symmetry.

(12) This effect is strongly enhanced by the increase in γ that occurs in the limit that $\overline{\varphi}$ approaches 1. On the other hand, it is strongly diminished by the increase in the number of defects that appear in the same limit.

Chapter 91

on the other hand

91.1 Introduction

In the papers I proofread, *on the other hand* is used incorrectly much more often than it is used correctly.[1] Generally, in its proper use, this expression indicates some kind of opposition between the discussion appearing before and after it. Its use implies that the assertion which follows presents some sort of contrasting situation, point of view, result, idea, etc., with regard to the topic of discussion. There are two important points concerning its use: First, the main assertion of the statements appearing before and after *on the other hand* must have the same underlying topic, and, second, these assertions must present opposing or at least differing points of view. In other words, these statements must give different perspectives of a single thing.[2]

91.2 Incorrect use

The most common misuse of *on the other hand* is to indicate that the topic of discussion is changing. This expression can never be used in this way. On the contrary, its correct use generally implies the continuation of the topic of discussion. In particular, use of this expression is not appropriate to connect two statements about two different things, even when these things are closely related. Its misuse most frequently appears in connecting two such statements that describe somehow contrasting situations. This misuse is illustrated by the following.

> (1) The solution ψ_1 is unstable. On the other hand, the solution ψ_2 is stable.
> (2) The solution ψ_1 is stable for $\beta < 1$. On the other hand, it is unstable for $\beta > 1$.

Note that the topic of the first sentence in (1) is the stability of ψ_1, and that of the second sentence is the stability of ψ_2. The sentences in (2) contrast two closely

[1] I believe this improper use results from direct translation of 一方. It is important to realize that the meaning of 一方 is much broader than that of *on the other hand*.

[2] For further discussion of *on the other hand* and comparison with *at the same time*, see Section 23.1.2.

related cases, as both concern ψ_1. However, the topics of these sentences are not both ψ_1 itself but, rather, its stability below and above $\beta = 1$, and therefore here too, the topic changes. In these examples, the assertions of the first and second sentences describe contrasting situations, but they cannot be regarded as presenting opposing views, because their topics differ. It is not clear what kind of logical connection was meant to be expressed by "on the other hand" in (1) and (2), but it seems that the intended meaning would be realized if it were replaced by *and*, *but*, *while* or *whereas*.

91.3 Correct use

An appropriate use of *on the other hand* is demonstrated by the example below.

> (1) The first method does not involve such a complicated integration, and for this reason it is usually more practical. On the other hand, the second method never produces unphysical solutions, and therefore it is more reliable.

In this example, while the first sentence discusses the "first method" and the second sentence the "second method," the main topic of both sentences is the relative utilities of the methods. (Note that in each sentence, one method is being compared with the other.) With regard to this single main topic, these two sentences provide opposing points of view.

For a second example, it is useful to return to (1) of the previous section and ask how *on the other hand* could be properly used in something similar. The problem with its use in that example is that the topics of the two statements are different. We now consider a situation in which similar statements could appear in a context in which there is a single main topic. Suppose we are studying the behavior of some equation that possesses two stable solutions, ψ_1 and ψ_2. Then let us assume that, according to some previous results, we know that only ψ_2 is 'physically realizable'. We then study how the behavior of the equation changes when it is subject to a particular perturbation. Suppose we find the following.

> (2) Mathematically, the effect of this perturbation is significant, as the solution ψ_1 becomes unstable. On the other hand, physically this effect is insignificant, as the physically realizable solution, ψ_2, remains stable.

Here, the main topic of the two sentences is the same, namely, the effect of the perturbation. In this case, "on the other hand" is appropriate because, with regard to this topic, the two sentences present contrasting assertions from different points of view.

91.4 Examples

Below, I give a number of examples demonstrating the most common misuses of *on the other hand*.

91.4.1 Some simple examples: the pattern *A /is/does/... On the other hand B /is/does/...*

When making two statements about the identity, nature, behavior, etc., of two different things, even if these things are closely related and the statements present some kind of contrast, in general, they cannot be connected with *on the other hand*. The following are some fairly simple examples of this type of misuse.

(1) Here $\hat{h}_{mn}$ is the traceless part of $\overline{h}_{mn}$. On the other hand h_{mn} is the remaining part, $\overline{h}_{mn} - \hat{h}_{mn}$.
(1) Here $\hat{h}_{mn}$ is the traceless part of $\overline{h}_{mn}$, and h_{mn} is the remaining part, $\overline{h}_{mn} - \hat{h}_{mn}$.
(2) The quantities $F^L_{\mu\nu}$ and $F^R_{\mu\nu}$ are local field strengths; on the other hand, $F_{\eta\eta}$ and $F_{\mu\eta}$ are bi-local field strengths.
(2) The quantities $F^L_{\mu\nu}$ and $F^R_{\mu\nu}$ are local field strengths, and $F_{\eta\eta}$ and $F_{\mu\eta}$ are bi-local field strengths.
(3) It is thus obvious that by taking the limit $\chi \to \chi_\mu$, the extended derivative operator D^{R+}_μ tends to the local operator ∂^+_μ. On the other hand, its partner, D^{R-}_μ, tends to $-ig\partial^-_\mu$.
(3) It is thus obvious that by taking the limit $\chi \to \chi_\mu$, the extended derivative operator D^{R+}_μ tends to the local operator ∂^+_μ. Similarly, its partner, D^{R-}_μ, tends to $-ig\partial^-_\mu$.
(3*) It is thus obvious that by taking the limit $\chi \to \chi_\mu$, the extended derivative operator D^{R+}_μ tends to the local operator ∂^+_μ, while its partner, D^{R-}_μ, tends to $-ig\partial^-_\mu$.
(4) Player 1 succeeded in constructing a productive game environment. On the other hand, player 2 failed to do so.
(4) Player 1 succeeded in constructing a productive game environment, /but/while/ player 2 failed to do so.
(5) Under this extension, the Higgs-like fields in this model become bi-local. On the other hand, the gauge fields and the matter fields remain local, existing in either the left or right world.
(5) Under this extension, the Higgs-like fields in this model become bi-local, /although/while/but/ the gauge fields and the matter fields remain local, existing in either the left or right world.
(5*) Under this extension, the Higgs-like fields in this model become bi-local. /However/By contrast/, the gauge fields and the matter fields remain local, existing in either the left or right world.
(6) In (a), the average value only with respect to the periodic part is plotted. On the other hand, the average value including the transient part is plotted in (b).
(6) In (a), the average value with respect to only the periodic part is plotted, /whereas/while/ in (b), the average value including the transient part is plotted.
(7) Here, the subscript denotes the multiplicity of the spin states, 2 for a spin-doublet and 4 for a spin-quartet. On the other hand, the superscript denotes the degeneracy of the SU(3) flavor state, 8 for a flavor-octet and

10 for a flavor-decouplet.
(7) Here, the subscript denotes the multiplicity of the spin states, 2 for a spin-doublet and 4 for a spin-quartet, and the superscript denotes the degeneracy of the SU(3) flavor state, 8 for a flavor-octet and 10 for a flavor-decouplet.

In each of the above examples, although the first and second sentences describe, in some sense, contrasting situations, there is no opposition represented by this contrast, because the topics of discussion differ. None of these examples present two points of view with regard to a single topic.

91.4.2 Some more complicated examples

The following examples are quite similar to those appearing above in that the first and second statements do not present opposing or contrasting assertions expressing two points of view regarding a single topic. The examples we consider in this section are somewhat more complicated only because of their sentence structure. It should also be noted that in most of these examples there are problems unrelated to the use of *on the other hand*, which I simply correct without specific comment.

> (8) Since this theorem concerns an analytic function defined on a Riemannian surface, the metric signature appropriate for this manifold is *Euclidean*. On the other hand, the background manifold which we have considered in this paper has *Lorentzian* signature.
> (8) Because this theorem concerns an analytic function defined on a Riemannian surface, the metric signature appropriate for this manifold is *Euclidean*. However, the background manifold that we have considered in this paper has *Lorentzian* signature.

Here, there is certainly a contrast expressed concerning the metric signature. However, this contrast concerns not the way in which a single metric signature appears from two different points of view but, instead, the difference between two metric signatures that are used in two different situations. Certainly the fact that the author considered a Lorentzian signature in the present situation does not oppose the fact that the Euclidean signature is appropriate in another situation. Even if the intended meaning were that a Euclidean signature is in fact appropriate in the situation studied in the present paper – and perhaps a Lorentzian signature was used inappropriately – "on the other hand" would be incorrect. The fact that the Euclidean signature is appropriate and the fact that the author used the Lorentzian signature are not in opposition. These two facts do not lead to or suggest two opposing conclusions. Rather, taken together, they simply imply that the author used the wrong signature.

> (9) We thus see that the irreversible work associated to both the loose regime and the tight regime can be made as small as we wish by allotting a large enough time for the operation. On the other hand, the quasi-static work associated with the change of ν within the region $\chi_{\alpha 0} \leq \chi_\alpha \leq \chi_{\alpha 1}$

can be evaluated by Eq.(3.1).
(9) We thus see that the irreversible work associated with both the loose regime and the tight regime can be made as small as we wish by allotting a large enough time for the operation. The quasi-static work associated with the change of ν within the region $\chi_{\alpha 0} \leq \chi_\alpha \leq \chi_{\alpha 1}$ can be evaluated using Eq.(3.1).

There is clearly no opposition between the points of view here, as the two sentences consider completely different things.

(10) The player of this species usually cuts tree 1 for successive several rounds, and as a result this tree becomes shorter and shorter, as the amount of lumber the player acquires at each round becomes less and less. On the other hand, tree 2 becomes taller and taller.
(10) The player of this species usually cuts tree 1 for several successive rounds, and as a result this tree becomes shorter and shorter, as the amount of lumber the player acquires each round becomes less and less. /Meanwhile/During this time/, tree 2 becomes taller and taller.

Again, these sentences do not in any way express opposing points of view.

(11) Using the conventional method, the evolution of the decision making function itself cannot be investigated. On the other hand, this evolution is systematically investigated using the S diagram in our method.
(11) Using the conventional method, the evolution of the decision making function itself cannot be investigated. Using the S diagram with our method, by contrast, this evolution can be systematically investigated.

Not only do the two sentences here lack opposition, but in fact, they both support the conclusion that "our method" is superior.

(12) The solution $\xi_+(\phi)$ is the only defect solution which satisfies the boundary conditions. This solution becomes identically zero at $d \leq 2$, and thus no defects exist in this case. On the other hand, this solution represents a defect for $d > 2$.
(12) The solution $\xi_+(\phi)$ is the only defect solution that satisfies the boundary conditions. This solution becomes identically zero for $d \leq 2$, and thus no defects exist in this case. For $d > 2$, however, this solution is non-zero. Hence in this regime the system possesses a defect.

The contrast presented here is that the defect solution is zero in one case and non-zero in the other. (This is obscured somewhat by the wording of the original.) Obviously, these assertions are not in opposition. In the sentence before "on the other hand," the topic of discussion is the nature of this solution and its implications in the $d \leq 2$ case, while in the sentence following this expression, it is the nature of this solution and its implications in the $d > 2$ case.

(13) It should be noted that only symmetric fluctuations exist initially. On the other hand, the inflaton itself generates asymmetric fluctuations.
(13) It should be noted that only symmetric fluctuations exist initially. The asymmetric fluctuations are entirely generated by the inflaton itself.

The two sentences here express no contrast. In fact their meanings are almost the same.

(14) This relation yields $\alpha < 2\gamma$. On the other hand, from (3.4), we have $\alpha < 2\pi$.
(14) This relation yields $\alpha < 2\gamma$. In addition, from (3.4), we have $\alpha < 2\pi$.

Here, the second sentence does not present contrasting information but, rather, supplemental information.

(15) The distribution of the average scores is quite smooth if we consider only the attractor part of the dynamics. On the other hand, if we include transient behavior in calculating the average score, when the number of rounds is small, this distribution is quite irregular.
(15) The distribution of the average scores is quite smooth if we consider only the attractor part of the dynamics. However, if we include transient behavior in calculating the average score, when the number of rounds is small, this distribution is quite irregular.

Here the contrast is between two different things, the distributions in the two cases.

(16) In this way an attractor can be defined topologically. On the other hand, Milnor (1985) defined an attractor from another viewpoint in which both topological and measure-theoretic concepts are taken into account.
(16) In this way an attractor can be defined topologically. However, there are other ways to define attractors. For example, employing a different point of view, Milnor (1985) defined an attractor in terms of both topological and measure-theoretic concepts.

There is nothing even contrastive expressed by the assertions before and after "on the other hand" in this case.

(17) Thermodynamics, which is the study of heat, has been studied for many years, and a number relations have been derived about the flow of heat and its conversion into other forms of energy. On the other hand, Brownian motion has also been studied for many years, and projection methods developed in this study have allowed for the derivation of Langevin dynamics from microscopic Hamiltonian mechanics.
(17) Thermodynamics, which is the study of heat, has been investigated for many years, and a number relations have been derived concerning the flow of heat and its conversion into other forms of energy. Brownian

motion has also been studied for many years, and projection methods developed in this study have allowed for the derivation of Langevin dynamics from microscopic Hamiltonian mechanics.

Again, there is no contrast presented by the statements before and after "on the other hand." The topic of discussion simply changes. Of course, the two types of study discussed here are in some sense contrasting, but the assertions of the two sentences themselves express no contrast. Taken together, they simply imply that two different approaches to the investigation of a particular class of physical phenomena have been used.

(18) When $0 < \alpha < \alpha_0$, the equilibration time is long enough that the change in the small system can be thought of as quasi-static. On the other hand, the regime $\alpha_1 < \alpha < 1$ corresponds to the case in which the equilibration time is much shorter than what can be discerned experimentally.
(18) For $0 < \alpha < \alpha_0$, the equilibration time is sufficiently long that the change in the small system can be thought of as quasi-static. Considering the other extreme, for $\alpha_1 < \alpha < 1$, the equilibration time is much shorter than what can be discerned experimentally.

Here there is contrast between the statements before and after "on the other hand," but again, the topic of discussion changes, as the first and second sentences regard the small α and large α regimes, respectively. Clearly, these assertions concerning the equilibriation times in two independent regimes cannot be in opposition.

(19) Since the late 1940s, there have been great theoretical and experimental efforts aimed at understanding such systems at very low temperatures, and their behavior in this regime is fairly well understood. On the other hand, in 1992, employing a novel calculational technique, Allison and Carew carried out the first systematic investigation of their 'high-temperature' behavior.
(19) Since the late 1940s, there have been many theoretical and experimental investigations of such systems at very low temperatures, and their behavior in this regime is fairly well understood. Then, in 1992, employing a novel calculational technique, Allison and Carew carried out the first systematic investigation of their 'high-temperature' behavior.

Again there is clearly nothing expressed by the second sentence that opposes or even contrasts with the assertions of the first sentence.

(20) The work required to change the parameter a during the quasi-static adiabatic process A→B is less than W_h. On the other hand, we can also consider the process B→A.
(20) The work required to change the parameter a during the quasi-static adiabatic process A→B is less than W_h. Of course, we can also consider the process B→A.

Here, the ideas expressed by the two sentences are not even contrastive.

91.4.3 Unclear opposition

In the following examples, there seem to be some opposing views presented by the first and second sentences, but because this opposition is not clear, *on the other hand* is not appropriate.

> (21) Since the interaction between a vortex and the insect's wing is simple, the lift generated by a single vortex is essentially symmetric. On the other hand, the long lifetime of vortices implies that vortices produced in different downstrokes may interact.
> (21) Because the interaction between a vortex and the insect's wing is simple, the lift generated by a single vortex is essentially symmetric. However, the long lifetime of vortices implies that vortices produced in different downstrokes may interact.
> (21*) Because the interaction between a vortex and the insect's wing is simple, the lift generated by each vortex individually is essentially symmetric. On the other hand, the long lifetime of vortices implies that vortices produced in different downstrokes may interact, and it is known that interactions among vortices can lead to asymmetric effects.
> (22) Because the T-duality group $\mathcal{G}$ is a subgroup of the U-duality group, it has a special property: It is the maximum subgroup which consists of the elements that transform H-S and Q-Y fields into themselves. On the other hand, we often encounter situations in which H-S and Q-Y fields are better treated in a different way.
> (22) Because the T-duality group $\mathcal{G}$ is a subgroup of the U-duality group it has a special property: It is the maximum subgroup consisting of the elements that transform H-S and Q-Y fields into themselves. However, while this property is convenient in some situations, we often encounter situations in which H-S and Q-Y fields are better treated in a different way.

In (21), it appears that the author intended for the two sentences to describe effects with opposing implications concerning the symmetry of the lift experienced by the insect. However, it is not clear whether the facts presented in these sentences alone support opposing conclusions in this regard. For this reason, here too the use of "on the other hand" is incorrect. Note that, in contrast to the original, (21*) explains clearly how there are two opposing factors to be considered. In (22), the sentences may be viewed as expressing opposing facts with regard to the usefulness of the T-duality group in the treatment of the fields in question. However, the statements given in the two sentences themselves are not in opposition, as the meaning of the first is simply that $\mathcal{G}$ has a special property and that of the second is that in some cases it is better to use methods that do not involve $\mathcal{G}$.

91.5 Further examples of proper use

After studying the various examples above demonstrating the improper use of *on the other hand*, it is useful to reconsider its proper use. In all of the examples below,

the main topic of discussion is unchanged, and the two sentences appearing before and after "on the other hand" express opposing points of view with regard to this single topic.

> (1) The T*-product is certainly very convenient, because we need not be concerned with the order of operation, even for field operators that are separated in a time-like manner. On the other hand, as emphasized in the present paper, the T*-product can create serious problems involving the explicit violation of the field equations.
> (2) This treatment ignores the difference in symmetry of the two systems. On the other hand, our main interest here is in certain aspects of the macroscopic behavior that are independent of the symmetry.
> (3) When an unproductive wheat field is left fallow for a sufficiently long time, there is a possibility that it will regain its productivity. On the other hand, if the field is left fallow for too long, long-term productivity will inevitably decrease.
> (4) In modern science, deductive and inductive methods are often employed side by side. However, this has not always been the case, and in fact in the seventeenth century, there was a sharp split between the supporters of the two methods. It is difficult to judge which, if either, had a greater influence on the development of science prior to the twentieth century. Certainly, the deductive method of Galileo and Descartes was almost solely responsible for the development of science that took place in the seventeenth century and of physics well beyond that time. On the other hand, the inductive method of Bacon led to the advances in evolutionary geology and biology that occurred in the nineteenth century.
> (5) This finding could be interpreted as implying the non-physical nature of the solution ϕ_1. On the other hand, it could simply be interpreted as demonstrating the limitations of our method.

The topic of discussion in (1) is the utility of the T*-product. The first sentence clearly expresses a merit of its use, while the second sentence clearly expresses a demerit. The discussion of (2) is with regard to the appropriateness of the treatment in question. The first sentence raises a question concerning its appropriateness, while the second gives reason to disregard this question. Example (3) concerns the advantage of leaving a field fallow. The first sentence states what can be gained by doing this, and the second states what can be lost. The sentences appearing directly before and after "on the other hand" in (4) regard two different methods of reasoning, and thus it may seem that here the topic has changed. However, considered within the context provided by the preceding discussion, these sentences present two contrasting points of view concerning a single topic, namely the philosophy of science and, more specifically, the question of what form of logical reasoning has contributed most to scientific progress. The two sentences in (5) clearly present two points of view about the same thing, that is, the interpretation of "this finding."

Chapter 92

operate

There are two types of misuse of the verb *operate* that I encounter.

92.1 Misuse with the operator acting as the direct object

That which carries out the action expressed by the verb *operate* can be referred to as an 'operator'. (Of course, such terminology is quite familiar in mathematics and physics, but in fact it is not limited to mathematical contexts.) The first important point to understand in such usage is that this operator itself cannot act as the direct object of the verb *operate*. This should be clear from purely grammatical considerations: While a direct object represents that *to which* an action is carried out, an operator itself carries out the action of operating. Grammatically, the relation between an operator and the verb *operate* is that the former should act as the *subject* of the latter.

Erroneous usage of *operate* in which the expression playing the role of the operator acts as the direct object, exemplified by the following, is quite common.

> (1) When we operate P on the right-hand side from the left, we obtain the following:
> (1) When we operate on the right-hand side of (2.1) from the left with P, we obtain the following:
> (1*) When P operates on the right-hand side of (2.1) from the left, the following is obtained:
> (2) We operate $\tau_{\rightarrow}$ to the functions $f_\mu(x)$.
> (2) We operate with $\tau_{\rightarrow}$ on the functions $f_\mu(x)$.
> (2*) $\tau_{\rightarrow}$ operates on the functions $f_\mu(x)$.
> (3) Let us now operate the linear operator $L(\tau)$ to both sides of this equation.
> (3) Let us now operate with the linear operator $L(\tau)$ on both sides of this equation.

When used in the manner demonstrated above, *operate* is an intransitive verb, and therefore it cannot take a direct object. The authors of the original sentences here

have attempted to use it as a transitive verb, with the direct objects "P," "$\tau_\rightarrow$" and "$L(\tau)$."

The grammatical problem considered above is the same as that involving *multiply* illustrated by (6) in Section 1 of Chapter 80. In that example, "a" acts as the object of the verb "multiply." (Mathematically, of course, there is a slight difference between that situation and those described by the above examples.)

92.2 Problem of preposition choice

Example (3) above demonstrates a common problem involving preposition use with *operate*. There, the object on which the operator "$L(\tau)$" acts (i.e. "both sides") is introduced by the preposition "to." This usage is incorrect, as *to* simply does not possess a meaning that would yield a meaningful expression here. The only preposition that can be used in this situation is *on*, as illustrated by (3). The following examples are similar.

> (1) There is evidence suggesting that input signals can operate to a single neuron in a complicated manner.
> (2) In this sense, f can be considered as operating to itself.

In both of these sentences, "to" should be changed to *on*. Here, the operators are "input signals" and "f," and those things on which they operate are "neuron" and "itself."

The above examples should be compared with (4)–(6) in Section 1 of Chapter 80.

Chapter 93

opposite

93.1 Correct usage

Before considering the improper use of *opposite*, let us consider it proper use. As demonstrated by the examples below, *oppoiste* can act as an adjective, adverb, noun or preposition.

adjective

(1) a and b are opposite.
(2) The effect of adding this term is opposite to that expected.
(3) a and b have opposite values.
(4) a has the opposite value of b.
(5) b is at one corner, and a is at the opposite corner.
(6) We thus arrive at a conclusion that is precisely opposite to that obtained previously.

adverb

(7) The points p_1 and p_2 are situated opposite on the hexagon.

noun

(8) We thus arrive at a conclusion that is precisely the opposite of that obtained previously.

preposition

(9) The largest domain is situated opposite the smallest.

In the following sections I present examples representative of the misuses that I encounter.

93.2 Split *opposite to*

The expression *opposite to* is an adjective-preposition set.[1] In general, this set should not be split. Such misuse is demonstrated below.

[1]For discussion of other expressions of this kind, see Chapters 37, 47 and 113.

(1) α has opposite sign to that of γ.
(1) α and γ have opposite signs.
(1*) The sign of α is opposite to that of γ.
(1**) α and γ are of opposite sign.
(2) This is in some sense the opposite form of reasoning to that given in Ref. [4].
(2) This form of reasoning is in some sense the opposite of that given in Ref. [4].
(2*) This form of reasoning is in some sense opposite to that given in Ref. [4].
(2**) This form of reasoning and that given in Ref. [4] are in some sense opposite.
(3) This state has opposite chirality to the corresponding state in the supersymmetric case.
(3) The chirality of this state is opposite to that of the corresponding state in the supersymmetric case.
(3*) This state and the corresponding state in the supersymmetric case are of opposite chirality.
(3**) This state and the corresponding state in the supersymmetric case have opposite chiralities.

While each of the original sentences here has several problems, the main problem results from the splitting of "opposite to." As illustrated by the above examples, when this is done, the resulting sentence is usually very awkward. The source of this incorrect usage seems to be the misunderstanding that because *opposite* is an adjective it must appear before the noun it modifies. This is simply not true. Note that (1*), (2*) and (3) demonstrate proper uses of "opposite to." In each case, this expression appears after the modified noun ("sign," "reasoning" and "chirality").

There is a second, somewhat subtle problem with (1) and (3). Note that in each of these sentences, the noun modified by "opposite" refers to a specific property of a specific quantity. In (1), "opposite sign" refers to the sign of "α," and in (3) "opposite chirality" refers to the chirality of "this state." Here, "sign" and "chirality" are *not* used in reference to the abstract properties of sign and chirality but to an actual, specific sign and chirality. For this reason, the definite article *the* must be used with this noun. In each of the corrected versions above, in the case that the noun modified by "opposite" refers to something specific, this is made clear by the use of "the" or "this" directly before this noun or by the fact that this noun is in plural form. In (1**) and (3*), the nouns "sign" and "chirality" refer to the abstract properties of sign and chirality. Finally, note that in each of the corrected versions except (2), "opposite" acts as an adjective. In (2), it is a noun.

93.3 Misuse with *sign*

Misuse of *opposite* with the noun *sign* is very common. One such example appears above. The following illustrate further typical problems.

(1) The angle of deviation of the step line l_α is in the opposite sign to that of the step line l_β.
(1) The angles of deviation of the step lines l_α and l_β have opposite signs.
(1*) The angles of deviation of the step lines l_α and l_β are of opposite sign.
(2) The sum of the circulations of the vortices v_i is equal to the opposite sign of $\tilde{v}_i$.
(2) The sum of the circulations of the vortices v_i is the opposite of that of the vortices $\tilde{v}_i$.
(2*) The sum of the circulations of the vortices v_i and that of the vortices $\tilde{v}_i$ are of equal magnitude and opposite sign.
(2**) We have the relation $\sum_i c_i = -\sum_i \tilde{c}_i$ for the circulations c_i and $\tilde{c}_i$ of the vortices v_i and $\tilde{v}_i$.
(3) The statistical average of the work needed for the process $\{T_1; T_2\}$ is equal and of opposite sign to that for the process $\{T_3; T_4\}$.
(3) The statistical averages of the work required for the processes $\{T_1; T_2\}$ and $\{T_3; T_4\}$ are opposite.
(3*) The statistical average of the work required for the process $\{T_1; T_2\}$ is opposite to that for the process $\{T_3; T_4\}$.

93.4 Problems with *the*

In Section 2, I briefly discussed one type of problem involving the definite article *the* that sometimes accompanies the use of *opposite*. Here I treat two different types of problems.

93.4.1 Missing *the*

Consider the following.

(1) In one extreme, the system exhibits a bcc structure. In opposite extreme, a weak lamellar structure appears.
(1) In one extreme, the system exhibits a bcc structure. In the opposite extreme, it exhibits a weak lamellar structure.

In this situation, "extreme" refers to a concrete and specific extreme, as opposed to the abstract concept. For this reason, an article (either *an* or *the*) must be used. Then, because this extreme is uniquely identified – as that which is opposite to the extreme in which the bcc structure appears – the definite article is the correct choice. It is important to note here that usually, use of the adjective *opposite* itself uniquely identifies (in a grammatical sense) the noun it modifies, and for this reason, use of the indefinite article with *opposite* is quite rare.

There is an important point regarding English composition, unrelated to the use of *opposite*, that should be observed here. Note that the main structures of the two sentences in (1) are "system exhibits structure" and "structure appears." Therefore in the first sentence, "structure" is the direct object of the verb, while

in the second sentence, it is the subject. In general, it is best to avoid this kind of unbalanced structure. The parallel structure "...system exhibits...structure. ...it exhibits...structure" of (1) is preferable.

93.4.2 Unnecessary *the*

Let us now study an example demonstrating a situation that contrasts with that of (1).

> (2) These points are on the opposite sides of the parent crack surface.
> (2) These points are on opposite sides of the parent crack surface.

In this example, because "opposite" expresses a relative meaning, no article is needed. Note that in this sentence the intention is only to describe the relation between the positions of the two points. There is nothing here that identifies nor attempts to identify the side corresponding to either point. If we interpret (2) literally, it describes the situation in which it is not the relation among "these points" with respect to which these "sides" are opposite but, rather, the relation between "these points" and some other, unnamed things.

93.5 Used with inappropriate modifiers

The relation described by the adjective *opposite* does not exist in degrees. For this reason, it cannot be modified by adverbs that connote degree, as illustrated by the following.

> (1) The initial directions of these flows are completely opposite.
> (1) The initial directions of these flows are opposite.
> (1*) These flows are initially oppositely directed.
> (1**) These flows are initially in opposite directions.
> (2) Actual values of γ observed in biological systems are strictly positive, which is rather opposite to the present result.
> (2) Actual values of γ observed in biological systems are strictly positive, which is in contradiction with the present result.
> (2*) Actual values of γ observed in biological systems are strictly positive, which is inconsistent with the present result.
> (2**) Actual values of γ observed in biological systems are strictly positive, which is the opposite of the present result.

The author's intention in (2) is somewhat unclear. The meaning expressed by (2) and (2*) is simply that the values of "γ" obtained in the "present result" are not strictly positive, whereas that expressed by (2**) is that these values of "γ" are strictly negative.

93.6 Misuse with *each other*

Generally, when the adjective *opposite* is used to describe the relation between two things, it is not necessary to include the phrase *each other*.[2] It may be thought that in some cases such a phrase is needed to avoid ambiguity, but almost always there is a better option. Consider the following.[3]

> (1) In this case, the two units can be constrained with opposite phases each other.
> (1) In this case, the two units can be constrained to have opposite phases.
> (2) In the $t \to \infty$ limit, these quantities approach the opposite value each other.
> (2) In the $t \to \infty$ limit, these quantities approach opposite values.
> (3) The color antisymmetry property implies that these two quarks have the opposite color charge each other.
> (3) The color antisymmetry property implies that these two quarks have opposite color charges.

In each of the original sentences here, not only is the meaning expressed by "each other" both inappropriate and unnecessary, but also the manner in which it is used is grammatically incorrect. In (1), all problems can be solved by simply deleting "each other." In (2) and (3), however, there is the additional problem of ambiguity, resulting from use of the incorrect form of the noun modified by "opposite." It seems that the authors of the original sentences here may have recognized this problem and attempted to solve it by adding "each other." However, this expression in no way makes the intended meaning more clear. Interpreted strictly, the expressions "the opposite value" and "the opposite color charge" refer to a single value and a single charge. Hence, the originals seem to imply that the two "quantities" have the same value and the two "quarks" have the same color charge and that these are opposite to those of some different quantities and quarks that were considered previously. In fact, however, "the opposite value" and "the opposite color charge" are intended to refer to the value**s** of "these quantities" and the color charge**s** of "these two quarks," and therefore they must be changed to "opposite values" and "opposite color charges," as in (2) and (3).

[2]It should be noted that, unlike 互いに and 反対, the expressions *each other* and *opposite* are seldom used together. For example, A と B は互いに x 軸の反対側に位置している would be translated as *A and B are positioned on opposite sides of the x axis.*

[3]For further discussion of *each other*, see Chapter 53.

Chapter 94

or

There are several ways that the conjunction *or* is incorrectly used by Japanese authors. Here I discuss the most problematic of these.

94.1 *or* vs. *and*: the question of context

94.1.1 Introduction

Or is used to indicate the existence of possible **cases**. These cases can be actual, potential or contrary to fact,[1] as illustrated by the following.

> (1) According to the most common categorization scheme of geology, a rock is either igneous, sedimentary or metamorphic.
> (2) The experiment will begin in March or April.
> (3) These data exhibit best agreement with either the theory of Townsend or that of Webb, but we cannot be sure which until we carry out a more complete statistical analysis.

In the first example here, the three cases are all actual, as indeed there exist rocks of each kind mentioned. In the second example, each case is obviously potential. In the third example, one of the cases is contrary to fact (although we do not yet know which). The important point demonstrated by these examples is that *or* is used to indicate that the items in the series in which it appears represent possible cases that may or may not be realized. Of course, in general, whether a given case under consideration is possible or not depends on the context of the sentence in which it is presented. Often, the question of context requires no careful thought, as in (2) and (3). The situation is different for (1), however. Because rocks of igneous, sedimentary and metamorphic types all do exist, it may seem that each of these cases is necessarily realized. However, note that here the context is an arbitrary, single rock. Thus, the meaning of this sentence is that if we consider a given, arbitrary rock, there are three possible cases regarding its type, only one of which can be

[1] Although, there are situations in which none of these characterizations is appropriate.

realized.[2] For this reason, the use of "or" here is appropriate. Now, contrast this situation with that presented by the following.

> (1′) According to the most common categorization scheme of geology, there are igneous, sedimentary or metamorphic rocks.

This use of "or" is incorrect, because the context here, in contrast to (1), is all the rocks that exist on Earth. Interpreted literally, this sentence means that, regarding the rocks existing in this world, there are three possible cases, that they are all igneous, that they are all sedimentary, and that they are all metamorphic. To express the intended meaning, "or" should be changed to *and*.

In the following sections, I treat several common misuses of *or*. For each of these, the problem results from a misunderstanding of the role of this word in presenting **cases** within a given context.

94.1.2 Misuse of *or* in place of *and*

The conjunction *or* is overused by Japanese authors. In the papers that I have proofread, approximately half the instances in which *or* is used in a series, *and* would be more appropriate.[3] When choosing between *or* and *and*, one needs to first determine the context of the statement under consideration. Then, if, within this context, the items in the series in question represent different possible cases, *or* should be used. If they do not, *and* should be used. The following are clear examples of the latter situation.

> (4) Mud, clay or wet sand are such representative materials we study in the present paper.
> (5) Much attention has been focused on electronic or mechanical properties of polymer systems.
> (6) We are interested in the non-Newtonian effects, for example shear thinning, shear thickening or plastic deformation.
> (7) We consider the system with noise or no noise.
> (8) Many important concepts, such as pattern formation or spatio-temporal

[2] In the above examples, *or* is used with an exclusive meaning; i.e., it expresses the meaning that only one of the cases under consideration is realizable. Of course, it can also be used with an inclusive meaning, as in the following: *I would be happy living closer to work or to a train station.* There are two potential cases here, that this person would be happy living closer to work and that she would be happy living closer to a train station. However, it is fairly clear that she would also be happy living both closer to work and closer to a train station. Thus, in the most natural interpretation of this sentence, "or" has an inclusive meaning. In some situations, it can be unclear whether *or* is intended to express an inclusive or exclusive meaning. For example, this is the case in the sentence *I would like an orange or an apple.* Here, either interpretation is possible. In general, if clarity in this regard is necessary, in the case that an inclusive meaning is intended, the phrase *or both* (or *or all three*, etc.), as in *I would like an apple or an orange or both*, should be added, while if an exclusive meaning is intended, the phrase *but not both*, as in *I would like an apple or an orange, but not both*, should be added. While it is important to understand the distinction between inclusive and exclusive *or*, this distinction is irrelevant to the main discussion of this chapter.

[3] For most of the examples appearing here, in the corresponding Japanese sentence, it seems that either や or または would most naturally play the role that here is erroneously played by "or." It should be noted that in many cases, や and または correspond to *and* rather than *or*.

chaos, have been born of the detailed study of such models.
(9) The magnetic sector is influenced by the non-perturbative magnetic mass in the static case or dynamic screening in the non-static case.

The meaning expressed by "or" in each of these sentences is inappropriate. In the first sentence, the context of the discussion is the entire paper, and therefore use of "or" indicates that there are three possible (or in some sense realizable) cases with respect to the entire paper: one in which the paper studies mud, one in which it studies clay, and one in which it studies wet sand. This seems to imply that the author is not sure about the content of his own paper or that he does not want to inform the reader about it. Obviously, however, the intended meaning is that all three of these materials are studied. (Note that there is another problem with this sentence. Owing to the use of "or" here, the subject is singular, and therefore the verb should be *is* instead of "are.") The context of the second sentence is the general study of polymer systems. Thus, the import of this sentence is that there are two possible cases with regard to the study of polymers, one in which much interest has been focused on electronic properties and one in which it has been focused on mechanical properties. The third sentence implies that the authors are interested in only one of these effects, but they are not sure which (or they do not want to tell the reader). Similarly, the fourth sentence would be interpreted as implying that the author is not sure which case is considered. The fifth sentence seems to suggest either that one or the other but not both of these concepts is important or that one or the other but not both of them resulted from the study of the models in question. The meaning expressed by the sixth sentence is that there are two possible situations, one in which the magnetic sector is influenced by the non-perturbative magnetic mass in the static case and one in which it is influenced by dynamic screening in the non-static case. Obviously, however, because the context of this sentence is the magnetic sector in *both* the static and non-static cases, there is only one situation, that in which the magnetic sector is influenced by the non-perturbative magnetic mass in the static case and by dynamic screening in the non-static case. To correctly express the intended meanings, in (4)–(6), (8) and (9), "or" should simply be replaced by *and*. Example (7) should be rewritten something like the following: *We consider the system both with and without noise.*

Now, compare the above sentences with the following.

(10) This equation can be solved using method A or method B.

The meaning expressed here is that there are two possible cases involved, one in which "method A" is used and one in which "method B" is used. In contrast to the above examples, in the situation considered here, this type of meaning is natural, and therefore this use of "or" is appropriate. In this sentence, "or" could be replaced by *and*, but this would change the meaning. Using *and* here, the most natural interpretation would be that both of these methods must be used to solve the equation.

94.1.3 Examples in which *or* and *and* can be used to express similar meanings

In many situations, either or *or* or *and* could be used to express the intended meaning. Once again, the most important concept here is that of context. The following demonstrate this point.

(11) Either the first or second method could be used.
(11*) The first and second methods can both be used.
(12) This quantity can be either negative or positive.
(12*) The situations in which this quantity is negative and positive are both possible.
(13) A single neuron or a neuron assembly can cause this behavior.
(13*) Both single neurons and neuron assemblies can cause this behavior.
(14) Thus this effect can cause either the collapse or emergence of such structures.
(14*) Thus this effect can cause both the collapse and emergence of such structures.

The correct interpretation of (11) is that both of these methods have the capability of being used for the purpose of interest. Note that the auxiliary verb "could," expressing potentiality, is important in making this clear. With this verb, the meaning of "either...or" regards our choice of which method to use, not the capabilities of the methods themselves. (If "could" were changed to *can*, the meaning of "either...or" would come to regard the capabilities of the methods, and as a result, "or" would no longer be appropriate.) Thus the context here concerns our choice. Within this context, there are two possible cases, that in which we use the first method and that in which we use the second method. Examples (11) and (11*) express similar meanings, but there is one important difference. It seems to be implied by (11) that the case in which we use both methods is not possible; that is, the interpretation that "or" expresses an inclusive meaning is somewhat unnatural. Contrastingly, (11*) seems to imply that the two methods can be (but do not necessarily have to be) used simultaneously. The context of this sentence is the entire realm of possibility concerning the capabilities of these methods. Within this context, there is only one case, that in which both methods "can be used." Thus in this sentence, "and" is appropriate.

In the situation described by (12), apparently "this quantity" exists within some model, theory, mathematical expression, etc., for which different cases can be realized and in each of which this quantity assumes a different value. Thus the context here is an arbitrary realization of "this value." The meaning of this sentence is that there are possible cases in which this quantity is negative and there are possible cases in which it is positive. In (12*), the context is the entirety of situations regarding the value of "this quantity." In this context, there is just one possibility, that in which it is both positive and negative. However, despite this difference in context, there is essentially no difference in meaning between (12) and (12*).

The context of (13) is an arbitrary realization of "this behavior." The implication of this sentence is that there are cases in which a single neuron causes this behavior

and cases in which a neuron assembly causes this behavior. (It seems that "or" is being used inclusively here and thus that the case in which a single neuron and a neuron assembly – or several or even many of each – cooperatively cause this behavior is also possible.) The meaning expressed by (13*) is essentially the same. Here, the context is the set of all possible occurrences of this behavior, and within this context, there is just one possible case.

The meaning of (14) is that "this effect" has the ability to (and indeed does) cause both the emergence and the destruction of "such structure." The context of (14) is an arbitrary, given situation, whereas that of (14*) is all possible situations. The meanings expressed by these sentences are essentially the same.

94.2 Ambiguous use of *or* in negative expressions

The use of *or* in negative sentences often involves a problem of ambiguity. This problem is demonstrated by the examples below.

> (1) In this case a or b does not exist.

This sentence is difficult to interpret. The following seem to be possible understandings.

> (1) In this case neither a nor b exists.
> (1*) In this case either only a or only b exists.
> (1**) In this case either only a or only b exists or neither exits.

The most natural interpretation of (1) is expressed by (1*), but in most cases that I find expressions like that in the original, the intended meaning is that of (1).

The following example is almost perfectly ambiguous.

> (2) This does not change either the energy or the spin.

Here, the following interpretations are equally natural.

> (2) This changes neither the energy nor spin.
> (2*) This changes the spin or the energy, but not both.

94.3 Misuse of articles with *or*

The example below illustrates a common misuse of the indefinite article.

> (1) In this case, there is only one non-degenerate eigenfunction, $v_1 = \sin(kx)$ or $v_2 = \sin(2kx)$. Thus the type of behavior described above is seen only for an eigenfunction v_1 or v_2.
> (1) ...Thus the type of behavior described above is seen only for the eigenfunction v_1 or v_2.

The misconception here seems to be that because the eigenfunction of interest has not been specified (that is, it could be either v_1 or v_2), the indefinite article must be used. This is incorrect. To understand the problem with (1), it is first necessary to

note that “an eigenfunction v_1 or v_2” means *an eigenfunction* v_1 *or an eigenfunction* v_2. Therefore “an” is attached to both “v_1” and “v_2,” and the implication of (1) is thus that there are multiple eigenfunctions referred to as “v_1” and multiple eigenfunctions referred to as “v_2.” However, this is obviously not true. Now, contrast the above example with the following: *Thus the type of behavior described above is seen only for an eigenfunction,* v_1 *or* v_2. In this case, the use of “an” is correct, because it is attached to the noun “eigenfunction,” and there indeed are multiple eigenfunctions (namely, v_1 and v_2) to which this word corresponds. However, this sentence could not be used in the situation described by (1), as the meaning is very different.

94.4 Misuse of *or* in expressions of correspondence between two series

In the following there is an expressed correspondence between items in two series: *In this equation* t_1 *and* t_2 *correspond to the time of engagement and the time of disengagement.* The meaning here is that “t_1” is the “time of engagement” and “t_2” is the “time of disengagement.” Note the use of “and” in this sentence. In expressions of this type, in general, *and* is appropriate, but I sometimes find *or* incorrectly used in its place. Here I present typical examples.

(1) We then compare the initial or final particle number with n_0 or n_1.
(1) We then compare the initial and final particle numbers with n_0 and n_1.
(2) This integral is equal to $\tan^{-1}(y)$ or $\tanh^{-1}(y)$ in prolate or oblate coordinates, respectively.
(2) This integral is equal to $\tan^{-1}(y)$ and $\tanh^{-1}(y)$ in prolate and oblate coordinates, respectively.
(2*) This integral is equal to $\tan^{-1}(y)$ in prolate coordinates and $\tanh^{-1}(y)$ in oblate coordinates.
(3) We denote the left or right term here by y_l or y_r, respectively.
(3) We denote the left and right terms here by y_l and y_r, respectively.
(3*) Here, we denote the left term by y_l and the right term by y_r.

The original sentences here are quite strange. For example, (1) appears to be asserting that either the initial particle number is compared with either n_0 or n_1 or the final particle number is compared with either n_0 or n_1. Obviously, this is not the intended meaning. In (1), *respectively* could be added to the end of the sentence to make the correspondence more explicit, but it is probably not needed. The wording in (2*) is somewhat smoother than that in (2).

Chapter 95

order

In this chapter, I address several frequently encountered problems involving the noun *order* when it is used to indicate the approximate size of some quantity.[1]

95.1 *on the order of* and *of order*

The most conventional (correct) phrases used to express the type of meaning considered in this chapter are *on the order of* (or *of the order of*) and *of order*. When proofreading papers written by Japanese authors, I find many variants of these expressions. For the most part, such variants are rather awkward (or grammatically incorrect), and they should be avoided.

The expressions *on the order of* and *of order* convey similar meanings, but there is a difference in their usage. The basic rule governing the use of these expressions is the following: *of order* is used in reference to dimensionless quantities, and *on the order of* is used in reference to dimensional quantities.

The examples presented in this section demonstrate the appropriate use of *order* in the present context.

95.1.1 Examples of correct use

Dimensional quantities

(1) The temperature of the system is on the order of 10K.
(2) This state has an energy on the order of 50eV.
(3) The characteristic timescale of the phase separation process is on the order of hours.
(4) The average velocity of the particles is on the order of .1c.
(5) This energy scale is on the order of the Planck mass.
(6) The overestimate is on the order of the size of the system.
(7) There are on the order of 100 particles in the reaction chamber.

[1] There are other meanings of this word often used in mathematics and physics, but such meanings are not considered here.

Dimensionless quantities

(8) The first term here is (of) order 1.
(9) This quantity is (of) order ϵ^2, and thus it does not appear at first order in the ϵ expansion.
(10) The size of the system is of order N^α, where N is the total number of particles.
(11) The dimensionless velocity of the front is (of) order $z^{3/2}$, which in the system described by Fig. 1 is approximately 0.05. This corresponds to a velocity on the order of .2 mm/sec in the 'typical' physical system considered in the previous section.
(12) This quantity is of order ρ_v/ρ_h, where ρ_v and ρ_h are the vertical and horizontal dimensions of the apparatus.
(13) All quantities appearing on the right-hand side of this equation are of order unity.
(14) The number of particles in the reaction chamber is of order 100.

95.1.2 Discussion

The phrasings employed above reflect the fact that in standard usage, *order* refers to a pure numerical value. The reason that this results in different expressions in the two situations considered here can be understood as follows. First, let us examine (1)–(7). Note that in each of these sentences, the object of the preposition "of" in the expression "on the order of" represents a physical quantity (temperature, energy, time, velocity, mass, system size, and particle number). The numbers that appear here act as adjectives, modifying the nouns representing these physical quantities. The implication of this grammatical structure is that the physical quantities do not themselves constitute orders but, rather, are characterized by them. This is clearly consistent with the standard usage of *order*. Now, let us consider (8)–(14). In contrast to the situation in (1)–(7), the numbers appearing in these sentences act grammatically as nouns. In each of these, the noun "order" and the number that appears after it refer to the same thing.[2] The implication of this grammatical construction is that these numbers themselves constitute orders. Again, this is consistent with the standard usage of *order*.

The following should also be noted. In some cases it is possible for an expression like *order + [pure number]* to act grammatically as an adjective (that is, "of" can be deleted in the phrase *of order*). This is quite natural in the situation that in the system under investigation there exists some system-characterizing (large or small) parameter in terms of which every relevant size can be expressed. For example, suppose we are considering a calculation that takes the form of a perturbative expansion in some small parameter ϵ. In such a situation, we can use expressions like *f is order* ϵ^3, *this quantity is order* $\epsilon^{1/2}$, α *is an order 1 parameter*, etc. This explains why "of" is optional in (8), (9) and (11) above.

Below I briefly discuss three of the above examples individually.

[2]This type of grammatical structure, in which nouns expressing the same meaning appear consecutively, is called 'apposition'.

First, in (6), because we could think of the size of the system as a dimensionless quantity, it may seem that the following phrasing is possible.

(6) The overestimate is of order the size of the system.

However, in fact this sentence is very problematic. The reason for this is that even in the case that we are thinking of the size of the system as a dimensionless quantity, the expression "the size of the system" itself does not represent this quantity mathematically. This point can be understood more clearly by comparing the above with the following proper usage.

(6*) The overestimate is of order $N^{1/2}$, the size of the system.

Next, let us consider (7) and (14). These appear to be making precisely the same statement, and it may thus seem strange that we use "on the order of" in one case and "of order" in the other. However, the difference here is easily understood from the discussion of grammar given above: In (7), "100" acts as an adjective, while in (14) it acts as a noun.

95.2 Additional types of usage

For reference, I give here some examples demonstrating the proper use of *order* in some situations related to those illustrated above.

(1) Here a is of higher order in δ than b.
(2) The values σ_1 and σ_2 are of the same order.
(3) The temperatures T_1 and T_2 are on the same order.
(4) A and B are of vastly different orders.

While "of" and "on" are interchangeable in (2) and (3), the former is perhaps better with dimensionless quantities and the latter with dimensional quantities.

95.3 Examples of misuse

Below I list a number of examples demonstrating the most frequently encountered incorrect use of *order*.

(1) x is of order a few tens of MeV.
(1) x is on the order of a few tens of MeV.
(2) This length is of order 10m.
(2) This length is on the order of 10m.
(3) γ is on the order of unity.
(3) γ is of order unity.
(4) This must hold to order of ϵ.
(4) This must hold to order ϵ.
(5) m_q is on the order of magnitude of 1 MeV.
(5) m_q is on the order of 1 MeV.

(6) We can assume that α is $O(\mathrm{eV})$.
(6) We can assume that α is on the order of several eV.
(7) This quantity is on the order of μV.
(7) This quantity is on the order of several μV.
(8) This is a deviation of the first order in ϵ.
(8) This is a deviation of first order in ϵ.
(9) We perform this calculation up to the first order.
(9) We perform this calculation up to first order.
(10) σ is of the order 1.
(10) σ is (of) order 1.
(11) This occurs only in the first order of the adiabatic expansion.
(11) This occurs only at first order in the adiabatic expansion.
(12) This modification is of the third order of α.
(12) This modification is third order in α.
(13) We expand this expression for the charge density up to the first order of the interaction, H_I.
(13) We expand this expression for the charge density (up) to first order in the interaction, H_I.
(14) x is the order of 10 μm.
(14) x is on the order of 10 μm.
(15) The remaining cross section in this momentum region is of order of 60 μb/sr.
(15) The remaining cross section in this momentum region is on the order of 60 μb/sr.
(16) ω_B is order of the difference between ϕ and $\hat{\phi}$.
(16) ω_B is of order $|\phi - \hat{\phi}|$.
(16*) ω_B is of the order of the difference between ϕ and $\hat{\phi}$.

Chapter 96

otherwise

The word *otherwise* can be used as either an adjective or an adverb.[1] Its correct uses are demonstrated by the following.

> (1) These limits must be taken in the proper order. Otherwise the effect of the local interactions may be completely lost.
> (2) It must be the case that $\langle V \rangle = \alpha^2/2$, because otherwise the solution would diverge in the $x \to \pm\infty$ limits.
> (3) However, our results lead us to conclude otherwise.
> (4) This is an otherwise reasonable assumption.
> (5) We thus obtain the residual charge, otherwise known as the 'charge of switching'.
> (6) This procedure allows us to easily derive an exact expression for γ, which otherwise we would have had to approximate using the laborious iterative method.
> (7) The first term is easy to treat. The second term is otherwise.
> (8) The wild activity of the neuron in this range contrasts with its quiescence otherwise.

In (1)–(6), "otherwise" is used as an adverb. In (7) and (8) it is an adjective. Its meaning in each case is as follows: in (1), *if not done in this way*; in (2), *if this were not the case*; in (3), *differently*; in (4), *in all other respects*; in (5), *also*, *sometimes* or *in other contexts*; in (6), *had we proceeded differently*; in (7), *not so* or *different*; in (8), *in all other cases*.

Although *otherwise* can be correctly used as only an adverb, an adjective or (rarely) a noun, sometimes I find it used as other parts of speech. The following is representative of one such mistake.

> (9) The system must be very small, otherwise the above condition cannot be satisfied.

The two clauses here, "the system must be very small" and "otherwise the above condition cannot be satisfied," are independent clauses, and thus they must be joined

[1] When used as an adverb, it often acts as a 'linking adverb' to link sentences or clauses. Occasionally, it is also used as a noun, but such usage can be ignored here.

by a conjunction (*and*, *but*, *as*, *because*...). The author apparently attempted to use "otherwise" in this role, but the result is a run-on sentence. The following are two possible ways of rewriting (9).

> (9) In order for the above condition to be satisfied, the system must be very small.
> (9*) The system must be very small. Otherwise the above condition cannot be satisfied.

Note that although there is no grammatical problem with (9*), (9) more naturally expresses the intended meaning.

The sentences below demonstrate misuse similar to that in (9).

> (10) In this case, Al cannot be deposited in the manner described above, otherwise the films would be electrically broken down.
> (10) In this case, Al cannot be deposited in the manner described above, or the films would be electrically broken down.
> (10*) In this case, Al cannot be deposited in the manner described above, because if it were, the films would be electrically broken down.
> (11) But brain activity must be interpreted according to some method, otherwise we would have no chance to understand even the simplest behavior.
> (11) But brain activity must be interpreted according to some method. Otherwise we would have no chance to understand even the simplest behavior.
> (11*) But brain activity must be interpreted according to some method, /as/because/ otherwise, we would have no chance to understand even the simplest behavior.

As is the case for (9) and (11), the grammatical problem in (10) could be solved by simply ending the first sentence at the comma and beginning a new one with "otherwise." However, the resulting expression would be somewhat unclear and conversational in tone.

The following is typical of a different type of mistake.

> (12) The potential must have two local minima, otherwise three local minima with one located at $x = 0$.

The main problem here is that because *otherwise* can function as only an adjective or an adverb (ignoring its rare use as a noun), it must modify something (namely, a noun, a verb an adjective or an adverb), but in the present sentence, it modifies nothing.[2] It appears that "otherwise three...$x = 0$" was meant to express the meaning *otherwise it must have three...*$x = 0$, in which case "otherwise" would modify the verb "must have." However, rewritten in this way, this sentence would have the same problem as (9)–(11). The rewritten form below represents perhaps the best way to express the intended meaning.

[2]The second problem with this sentence is that the assertion of the clause "the potential...minima" is in fact contradicted by the implication of the phrase "otherwise...$x = 0$."

(12) The potential must have either two local minima or three local minima with one located at $x = 0$.

Chapter 97

part of

In modern usage, the expression *part of* usually can act only to modify a singular noun.[1] This phrase makes reference to a constituent portion of some thing that is regarded as a single entity. The following sentence illustrates its correct use.

(1) Part of this sample undergoes the phase transition prior to time t_0.

Here, "part of" is used with respect to the singular noun "sample," which is regarded as a single entity.

I often find *part of* misused with a plural noun, in which case it is intended to refer to some subset of a set of individual objects. The following are representative of its misuse.[2]

(2) A large part of these particles escape in the first 10 μsec.
(2) A large /fraction/ratio/percentage/number/ of these particles escape during the first 10 μsec.
(3) A part of these operators commute with P.
(3) /Some/Several/ of these operators commute with P.
(4) This result indicates that a part of the neurons do not generate spikes in the renewal manner.
(4) This result indicates that /some of the/certain/ neurons do not generate spikes in the renewal manner.

Due to the misuse of "part of," the meanings expressed by the above original sentences are quite unnatural. Example (2) somehow seems to imply that the particles break into pieces and a large piece of each particle escapes during the time in question. The connotation of (3) appears to be that the individual operators mentioned can be somehow decomposed into constituent pieces and that it is some of these pieces that commute with P. Although such a situation is possible, the intended

[1]Compare the uses of *part of* and *entire*, considered in Chapter 54.

[2]The confusion resulting in the misuse considered here seems to be due to the fact that, unlike *part of*, 一部 indeed can be used to express the meaning of a subset of some collection of individual entities. Thus, while the expressions アジアの一部の国, 会員の一部, 一部の種類の細胞 are quite natural, here, "一部" would not be translated as *part of*. Rather, these expressions would become */some/several/certain/a few/a number of/ Asian countries*, */some/several/certain/a few/a number of/ members*, and */some/several/certain/a few/a number of/ types of cells*.

meaning is obviously quite different. Similarly, the statement in (4) would be construed as regarding parts of each neuron.

The above examples illustrate situations in which the intention is to make a statement about some members of a collection of multiple objects, but due to the misuse of *part of*, the statement becomes one about pieces of each of these objects. Of course, there are situations in which in fact we do wish to discuss pieces of multiple objects. In such cases, the meaning of *part of* is appropriate, but because it can only be used with respect to singular nouns, care must be taken to properly express the intended meaning. To see this, consider the following.

> (5) In three-dimensional fractures, crack fronts usually form only a part of the peripheries of a fracture surface.
> (5) In a three-dimensional fracture, a crack front usually forms only a part of the periphery of the fracture surface.
> (6) This is done with the real part of the functions $q(x), \Delta q(x)$ and $g_T(x)$.
> (6) This is done with the real parts of the functions $q(x)$, $\Delta q(x)$ and $g_T(x)$.

The first example here is better rewritten using singular nouns, as in (5). In the second example, using the plural "parts" makes it clear that we are interested in the real part of each function. (Use of the singular "part" in the original seemed to imply that there is a single "real part" that corresponds to these functions when they are considered together in some way.)

Chapter 98

per

There are three types of problems I find involving use of the preposition *per*.[1]

98.1 Misused with *one*, *each* and *every*

The words *one*, *each* and *every* should never be used together with *per*, because this preposition by itself means *to each*, *for each*, *by each*, *for every*, or something similar.[2] The following are typical.

> (1) There is thus an average of four new cells added per each time step.
> (1) There is thus an average of four new cells added /per/every/each/in one/ time step.
> (2) Until the critical time T_c, the linear density of the atypical variety is approximately one per 1 mm.
> (2) Until the critical time T_c, the linear density of the atypical variety is approximately one per millimeter.
> (3) The number of photons per each image is sufficiently small that each one photon image forms a separated cluster.
> (3) The number of photons per image is sufficiently small that each photon image forms a separated cluster.
> (4) Here, $\rho(\mathbf{x})$ represents the coarse-grained number of membranes per one unit length along the normal direction $\mathbf{n}(\mathbf{x})$.
> (4) Here, $\rho(\mathbf{x})$ represents the coarse-grained number of membranes per unit length along the normal direction $\mathbf{n}(\mathbf{x})$.

Note that in (3) there is also a problem with the expression "each one photon."

[1]There are two English meanings of *per*. (This word also appears in certain Latin phrases that are sometimes used in English. This use, however, is not of our concern.) The first meaning is *by means of*, and the second is *for each* or *for every*. We are only interested in the second meaning here.

[2]The confusion regarding the use of *per* apparently is due to the fact that there is not a direct correspondence between such expressions as ... に付き and ... 当たり and *per*. While the former are generally used as 一人に付き, 一日当たり, etc., the meaning of "一" here is contained in *per* itself.

98.2 Misused with an uncountable noun

The object of the preposition *per* must be a countable noun. For this reason, the types of usage demonstrated below are not possible.

> (1) The entropy per volume is S_0.
> (1) The entropy per unit volume is S_0.
> (1*) The entropy per volume element is S_0.
> (2) However, treating $\Delta\alpha$ as the change in α per work is not justified in the present case.
> (2) However, treating $\Delta\alpha$ as the change in α per unit of work is not justified in the present case.

98.3 Misuse of articles with the object of *per*

Like the adjectives *each* and *every*, the preposition *per* is used to simultaneously refer to all members of a group individually. For this reason, the object of *per* cannot take an article. The following is a typical mistake.

> (1) During this operation, the energy of the combined system per /the/a/ sub-system is given by $\mathcal{E} - \mathcal{E}_0$.
> (1) During this operation, the energy of the combined system per sub-system is given by $\mathcal{E} - \mathcal{E}_0$.

The use of "the/a" in the original gives the implication that there is just one "sub-system."

Chapter 99

plural

The adjective *plural* should not be used in place of *multiple*. These words are not synonymous. In fact, use of *plural* is quite rare, except in discussions of grammar.[1] The following are typical of the misuse I encounter.[2]

> (1) The situation regarding plural-person games is much more interesting.
> (2) However, this behavior is only seen in the case that plural units interact with antigens.
> (3) We would like to consider the general situation with plural type-I points.
> (4) It has been found that a network of leaky integrate-and-fire neurons cannot possess plural attractor states with biologically meaningful parameter values.

In each of these, "plural" should be replaced by *multiple*. In (1), *multi* could also be used.

[1]The other use of this word is in expressions like *plural society*, which means a society composed of multiple ethnic or cultural groups. However, this type of use is quite limited and specialized, and it need not be considered here.

[2]The misuse of *plural* clearly results from the mistaken translation of 複数. It is to be noted that only in grammatical contexts does 複数 correspond to *plural*.

Chapter 100

popular

The use of *popular* to mean *prevalent*, *usual* or *frequent* is a very common mistake among Japanese.[1] Although in one of its meanings, *popular* is synonymous with *prevalent*, this is a very minor meaning. Also, even when *popular* is used with such a meaning, it generally regards a society as a whole, carrying a meaning closer to *prevalent among the populace* than to *prevalent* alone. It is therefore best, particularly in physics and mathematics, to avoid *popular* when *prevalent*, *common*, *usual*, *frequent* or something similar is appropriate.

Here I present typical examples of the mistaken use of *popular*.

> (1) The path integral formalism is certainly the most popular method of solving such problems.
> (1) The path integral formalism is certainly the most /common/commonly used/ method of solving such problems.
> (1*) The path integral formalism is certainly the standard method of solving such problems.
> (1**) The path integral formalism is certainly the /predominantly/most frequently/ employed method of solving such problems.
> (2) Here we use the more popular notation $\hat{F}_{\mu\nu}$.
> (2) Here we use the more /common/standard/conventional/usual/customary/ notation $\hat{F}_{\mu\nu}$.
> (3) The most popular separation is given in the Einstein frame.
> (3) The /most commonly used/prevalent/usual/ separation is given in the Einstein frame.

Note that (1) and (1**) are essentially identical in meaning, as they both regard frequency of usage of the method under consideration. However, (1*) is somewhat different. Owing to its use of "standard," this sentence regards not frequency of usage but, rather, the general acceptance of this method as established and authoritative in the sense that it is the method with which others are compared. Thus, because a common method need not be standard nor a standard method common, the emphasis of (1*) differs from that of (1) and (1**). Despite this difference, however, in most situations all of these rewritten forms would be interchangeable.

[1] The misuse of *popular* by Japanese authors is apparently due to the fact that *popular* and ポピュラー are not equivalent in meaning.

The following are some of the words in place of which *popular* is often misused: *common*, *conventional*, *customary*, *general*, *generic*, *main*, *normal*, *ordinary*, *predominant*, *prevailing*, *prevalent*, *standard*, *typical*, *usual*.

Chapter 101

possible and *possibility*

The adjective *possible* and its noun form, *possibility*, are very often used incorrectly.

101.1 *possible*

101.1.1 Problematic use with infinitive clauses

The most common misuse of *possible* involves statements that when written correctly are of the forms below.

(1) It is possible to diagonalize this matrix.
(2) It is possible for these values to exceed $N|\tau|$.

In (1), the subject of the sentence is the pronoun "it," which refers to the infinitive clause[1] "to diagonalize this matrix."[2] The construction of the second sentence is very similar to that of the first. The difference between these constructions is that in (1), the infinitive clause has an object ("matrix") but no subject, while in (2), it has both an object ("$N|\tau|$") and a subject ("values"). These types of construction – *it is possible + [infinitive clause without subject]* and *it is possible for + [infinitive clause with subject]* – are used quite often in both written and spoken English. In the above examples, "possible" modifies "it." There are two mistaken constructions used very frequently by Japanese authors in place of those appearing in (1) and (2). In the first case, the mistaken construction is obtained by replacing the subject of the sentence, "it," with the object of the infinitive clause. In the second case, the mistaken construction is obtained by replacing the subject of the sentence with the subject of the infinitive clause. For example, in (1) and (2), these would yield the following.

(1) This matrix is possible to /diagonalize/be diagonalized/.
(2) These values are possible to exceed $N|\tau|$.

[1] An infinitive clause is a type of noun clause.

[2] The pronoun acting as the subject here is referred to as an 'empty subject'. In such a situation, it is also possible to use the infinitive clause as the subject (In the above case, we would have *To diagonalize this matrix is possible.*), but the resulting sentence is usually quite clumsy.

These sentences do not make sense.[3] Note that I have included both the active and passive forms of the verb in (1). I often find the above mistaken construction involving *possible* with both verb forms.[4]

The following examples illustrate some of the incorrect sentence constructions used in place of those demonstrated by (1) and (2).[5]

(3) The left-hand side is possible to be made arbitrarily small.
(3) It is possible to make the left-hand side arbitrarily small.
(3*) The left-hand side can be made arbitrarily small.
(4) This is a Gaussian function, making possible the matrix elements to be calculated analytically.
(4) Because this is a Gaussian function, the matrix elements can be calculated analytically.
(4*) Because this is a Gaussian function, it is possible to calculate the matrix elements analytically.
(4**) This is a Gaussian function, and therefore the matrix elements can be calculated analytically.
(4***) The Gaussian nature of this function makes it possible to calculate the matrix elements analytically.
(5) This formula makes us possible to calculate the off-diagonal components of M.
(5) This formula allows us to calculate the off-diagonal components of M.
(5*) This formula makes it possible to calculate the off-diagonal components of M.
(6) A game of this form is possible to be transformed into one of normal form.
(6) A game of this form can be transformed into one of normal form.
(6*) It is possible to transform a game of this form into one of normal form.
(7) The first element is possible to split and merge with the second and third.
(7) It is possible for the first element to split and merge with the second and third.
(7*) It is possible to split the first element and merge it with the second

[3] Some of the misuses of *possible* considered in this section seem to be due to misconceptions that arise from certain basic structural differences between English and Japanese. For example, if we were to translate the statement これらの値は、$N|\tau|$ を超えることが可能である directly, we would obtain (2). Another source of confusion may be the misguided analogy to the proper use of the adjective *likely* demonstrated by the following sentence.

This value is likely to /increase/be increased/.

As illustrated here, this type of construction with *likely* can be used with both active and passive verbs.

[4] It is interesting that with the active verb form, the type of construction in (1) can be used with *impossible*, however. For example, the following is correct: *This matrix is impossible to diagonalize.*

[5] I occasionally find similar problems involving the adjectives *feasible*, *plausible*, *reasonable* and *viable*.

and third.
(8) This method is possible to solve all of these problems.
(8) This method is capable of solving all of these problems.
(8*) It is possible to solve all of these problems using this method.
(9) This yields an expression that is possible to be solved analytically.
(9) This yields an expression that can be solved analytically.
(9*) This yields an expression that is possible to solve analytically.

In each of the original sentences here, the possibility is expressed with respect to the wrong thing. These possibilities are meant to be in regard to the actions of "making small," "calculating analytically," "calculating," "transforming," "splitting and merging," "solving" and "solving," but they are actually expressed in regard to "left-hand side," "matrix elements," "us," "game," "element," "method" and "expression," the nouns modified by "possible" in these original sentences.

Grammatically, the problem in each of the above original sentences results from the misuse of "possible" with an infinitive clause (specifically, "to be...small"; "to be...analytically"; "to calculate...M"; "to be...form"; "to split...third"; "to solve... problems"; "to be...analytically").

101.1.2 Different types of problems

The examples below demonstrate some different types of problems that are commonly involved with the use of *possible*.

(10) Possible processes belonging to the Y-type are the $K^- p \to f_0\Lambda, a_0\Lambda,$ and $\phi\Lambda$ reactions.
(10) Processes that possibly belong to the Y-type are the $K^- p \to f_0\Lambda, a_0\Lambda,$ and $\phi\Lambda$ reactions.
(11) Ξ^*N interactions in ^{12}C could be a possible explanation of the difference.
(11) Ξ^*N interactions in ^{12}C offer a possible explanation of the difference.
(12) We attempt to present a possible mechanism that could account for this behavior.
(12) We present a mechanism that might account for this behavior.

The import of (10) is that the "processes" are possible. In fact, however, it is their belonging to the "Y-type" that is possible. Both (11) and (12) are redundant, as in each, "could" and "possible" express essentially the same meaning of potentiality. Also, in (12), it seems that "attempt" was used to realize consistency with the tentative meaning conveyed by "possible." This reflects a misconception.

101.2 *possibility*

101.2.1 Possibility possessed by the wrong thing

Consider the following examples.

(1) Quantum gravity has the possibility that it will become a simpler theory.
(1) It is possible that quantum gravity will become a simpler theory.
(1*) There is the possibility that quantum gravity will become a simpler theory.
(2) In the limited regime we studied, we have found that the velocity is proportional to ϵ. However, it has the possibility to have a more complicated ϵ dependence in the general case.
(2) ...However, it may have a more complicated ϵ dependence in the general case.
(2*) ...However, there is the possibility of it possessing a more complicated ϵ dependence in the general case.
(3) This model has the possibility to account for all existing experimental results.
(3) This model may be able to account for all existing experimental results.
(4) These terms have the possibility to be non-universal.
(4) These terms may be non-universal.

All four of the original sentences here are unnatural because they involve some inconsistency concerning point of view. Below I briefly discuss each.

The expression used in (1) is problematic from a scientific point of view. This sentence implies that the possibility for quantum gravity to become a simpler theory is contained in the theory itself; that is, it connotes that simplification may arise spontaneously from within the present theory. However, it is much more natural to think of this simplification as resulting from a process carried out external to the theory and thus to think of the possibility for this simplification as existing not within the theory itself but within the reality containing this theory. This meaning is correctly expressed by (1) and (1*).[6]

The situation is similar in (2). This sentence is poor because it expresses the idea that the possibility in question belongs to the velocity. Clearly, this is problematic on several levels. In particular, this sentence seems to imply that the velocity is presently proportional to ϵ in the general case, but this dependence may be different in the future. The rewritten forms do not carry such a meaning, because there, the possibility is not understood as belonging to the velocity itself.

Example (3) is problematic because it conveys the idea that whether this model will or will not be able to account for the results under consideration depends on some future development of the model. The intended (and more natural) meaning, however, is apparently that the model in its present form may account for these results, but this has simply not yet been verified. This is the meaning expressed by (3). If, however, the intended meaning is in fact that future development of the model may allow it to account for these results, then something like the following would be better than (3).

[6]Comparison of the following two expressions may provide further illumination of the present point: (i) この関数は発散する可能性がある, (ii) この関数が発散する可能性はある. In English, these would become something like (i) *This function has the possibility of diverging* and (ii) *There is a possibility that this function will diverge.* Of these, (ii) expresses a much more natural meaning.

(3*) Some improved form of this model may be capable of accounting for all existing experimental results.

The problem in (4) is clear.

101.2.2 Other problems

Here I present some examples that demonstrate different types of problems involving the use of *possibility*.

(5) We consider the possibility of deformed baryons in the excited states.
(5) We consider the possibility of deformed baryons existing in the excited states.
(6) One possibility to explain the inter-generation hierarchical mass structure will be the Frogatt-Nielsen mechanism.
(6) One possibility to account for the inter-generation hierarchical mass structure is the Frogatt-Nielsen mechanism.
(7) This two-photon absorption is possibly attributed to transitions to Coulombic nP-like states.
(7) This two-photon absorption is possibly attributable to transitions to Coulombic nP-like states.

The problem with (5) is that it does not clearly express what about the deformed baryons is possible. The intended meaning seems to be that this is their "existence." As demonstrated by (6), using *possibility* with a future tense verb usually results in an illogical statement. The implication of (7) is that the act of somebody attributing the two-photon absorption to these transitions is possible. This is obviously very strange.

101.3 Related words

The following illustrate problems similar to those discussed above involving the use of words related to *possible*.

(1) Hence K^+ condensation is very plausible to occur.
(1) Hence K^+ condensation is very plausible.
(1*) Hence it is very plausible for K^+ condensation to occur.
(2) This system is very feasible to form a spin doublet.
(2) It is very feasible for this system to form a spin doublet.
(2*) It is very feasible that this system will form a spin doublet.

Note that in (1), "plausible" is an adjective that is meant to modify "condensation," but the way this sentence stands, it is being incorrectly used to modify "occur." Similarly, (2) mistakenly expresses the idea that the "system" is feasible. The intended meaning, which is expressed by (2) and (2*), is that the "formation" is feasible.

Chapter 102

problem

102.1 Introduction

Apparently, there is widespread confusion among Japanese mathematicians and physicists regarding the meaning of the noun *problem*. In the context of physics and mathematics, *problem* refers to a task (usually a difficult task) to be carried out (for example, solving an equation, determining the mass of a particle, obtaining a theoretical description of some natural phenomenon, proving a theorem, devising an effective experimental method) or the proposition[1] calling for the performance of such a task.[2] It is particularly important to note here that in this usage, *problem* does **not** refer to an object of investigation or a topic of study. This is the point most often missed by Japanese mathematicians and physicists.

There are several misuses of *problem* that I encounter. Here I discuss the most serious of these.

[1] There are several meanings of the word *proposition*. That of relevance here is *a formal statement of an operation to be performed* (paraphrased from Definition 5 in the Oxford English Dictionary [4]).

[2] The pertinent definition in Webster's Revised Unabridged Dictionary [5], *anything which is required to be done; as, in geometry, to bisect a line, to draw a perpendicular; or, in algebra, to find an unknown quantity*, describes a task. Those given in Merriam-Webster's Collegiate Dictionary [3], *a proposition in mathematics or physics stating something to be done*, and the Encarta World English Dictionary [2], *a statement requiring mathematical solution: a statement or proposition requiring an algebraic, geometric, or other mathematical solution*, recognize a proposition for the performance of a task. The Oxford English Dictionary gives two pertinent definitions, (in geometry) *a proposition in which something is required to be done: opposed to theorem*, and (in physics and mathematics) *a question or inquiry which starting from some given conditions investigates some fact, result, or law.* The second of these warrants some explanation. Here, "question" is being used in the sense of an interrogative statement (for example, Definition 3a under *question* in the Oxford English Dictionary), while "inquiry" refers to an examination or act of inquiring (for example, see the Oxford English Dictionary). Thus this definition describes both a task and a proposition requiring the performance of a task.

102.2 Misused in reference to things that are not problems

In the examples that appear below, *problem* is used in reference to things that are not problems. These sentences demonstrate the most common misuse of this word.

(1) The second problem we wish to consider in biological systems is the emergence of certain types of pathways.
(1) The second type of phenomenon we wish to consider in biological systems is the emergence of certain types of pathways.
(1*) The second problem we wish to consider in biological systems is elucidating the emergence of certain types of pathways.
(2) Here we give a brief comment on the application of the Riemann-Roch theorem to the problem of two-dimensional quantum gravity.
(2) Here we give a brief comment on the application of the Riemann-Roch theorem to the study of two-dimensional quantum gravity.
(2*) Here we give a brief comment on the application of the Riemann-Roch theorem to the formulation of a theory of two-dimensional quantum gravity.
(2**) Here we give a brief comment on the application of the Riemann-Roch theorem to the problem of formulating two-dimensional quantum gravity.
(3) Although this theory has been successfully applied to various non-static problems of hadrons, there are several situations in which it is known to fail.
(3) Although this theory has been successfully applied to the description of various types of non-static behavior of hadrons, there are several situations in which it is known to fail.
(4) We apply the perturbative effective action approach to the problem of chiral symmetry breaking.
(4) We apply the perturbative effective action approach to the study of chiral symmetry breaking.
(4*) We apply the perturbative effective action approach in an attempt to understand chiral symmetry breaking.
(4**) We apply the perturbative effective action approach to the problem of describing chiral symmetry breaking.
(4***) We apply the perturbative effective action approach in an attempt to construct an improved theory of chiral symmetry breaking.
(5) This situation is analogous to the problem of the non-adiabaticity of chemical reactions.
(5) This situation is analogous to that of the non-adiabaticity of chemical reactions.
(5*) The cause of the non-adiabaticity in the present situation is analogous to that in chemical reactions.
(6) We now consider local changes of the domain wall structure that give rise to vortices. This problem was previously treated for the case of a

degenerate domain wall state.
(6) .../This behavior was/Such changes were/ previously studied for the case of a degenerate domain wall state.
(6*) ...Such an investigation was previously carried out for the case of a degenerate domain wall state.
(7) Any system of this kind involving multiple decision makers is called a "game." For such problems, there are many works that attempt to answer the basic question posed above.
(7) ...For such systems, there are many works that attempt to answer the basic question posed above.
(8) The application of these methods to biological systems is an important problem.
(8) The application of these methods to biological systems is an important subject of study.
(8*) Formulating the application of these methods to biological systems is an important problem.
(9) If two or more decision-makers who attempt to obtain optimal results interact, the result for each will in general depend on the actions of all those involved. Clearly, this problem is not of the kind discussed above.
(9) ...Clearly, this situation is not of the kind discussed above.
(9*) ...Clearly, the problem of fully describing this situation is not of the kind discussed above.
(10) This paper has not touched on the dynamic nature of the flip-flop states. This problem should be important in elucidating the origin of the complex structure of the frequency diagrams.
(10) ...An investigation of these states should be important in elucidating the origin of the complex structure of the frequency diagrams.

In each of the original sentences above, that to which "problem" refers is in fact not a problem. For example, consider (2) and (4). While there are certainly many problems involved in the study of two-dimensional gravity and chiral symmetry breaking, these phenomena themselves are objects or topics of study, not problems. The other examples are similar. If we changed "of" to *involving* in (3), the resulting sentence would be better than the original, but (3) expresses the intended meaning more clearly and naturally. Note that (5) has the logically problematic implication that a "situation" and a "problem" are analogous. In (6), it is unclear to what "problem" is referring. The three ways of rewriting this given in (6) and (6*) clearly express the possible interpretations. In (9), it seems that "problem" is being used in reference the "situation" described in the previous sentence.

The example given below represents a somewhat special type of the misuse studied in this section.

(11) Let us consider the following problem: $\frac{\partial u}{\partial t} = \nabla^2 u + F(u)$.
(11) Let us consider the equation $\frac{\partial u}{\partial t} = \nabla^2 u + F(u)$.
(11*) Let us consider the problem of solving the equation $\frac{\partial u}{\partial t} = \nabla^2 u + F(u)$.

In general, it is not correct to refer to an equation as a 'problem'. There may be an implicit or explicit problem of solving or carrying out some other task with regard to an equation, but in most cases, it is inappropriate to refer to an equation itself in this way. In most situations, (11) would be the most natural here. However, if there is the intention of emphasizing that what we are interested in is solving the equation, then (11*) would be better.

102.3 Imprecise use

In each of the following examples, that to which "problem" is meant to refer is indeed a problem, but the imprecise wording of the original results in a statement in which this word actually refers to something else.

> (1) In the case of finite-dimensional lattices, the central problem is to look for general laws governing the creation and growth of such clusters.
> (1) In the case of finite-dimensional lattices, the central problem is to /find/determine/formulate/ general laws governing the creation and growth of such clusters.
> (2) The relation of the behavior we have studied to chaotic itinerancy is a very interesting problem.
> (2) Determining the relation of the behavior we have studied to chaotic itinerancy is a very interesting problem.
> (3) The existence of memory states and the response to the invasion of antigens in a system with a large number of degrees of freedom are very interesting problems.
> (3) Describing the existence of memory states and the response to the invasion of antigens in a system with a large number of degrees of freedom are very interesting problems.
> (3*) Proving the existence of memory states and describing the response to the invasion of antigens in a system with a large number of degrees of freedom are very interesting problems.
> (4) Because of the double counting of the short-range correlation mentioned above, however, it is not clear whether the use of the effective forces in the particle-particle channel is appropriate. This is an open problem.
> (4) ...Obtaining a general result in this regard is an open problem.
> (5) It seems that under "normal" conditions, the asymmetric state becomes more stable near the critical point, but when a certain class of boundary conditions is used, the situation is reversed. The presence of noise also seems to effect this behavior quite strongly. These will be very interesting problems in the future.
> (5) ...The elucidation of these points is an interesting problem that we will consider in the future.
> (5*) ...We plan to study this interesting behavior in the future.

The point to note in regard to (1) is that it is somewhat unnatural to think of "looking for" something as a problem. Rather, here, it is more natural to think of

the task to be carried out as that of "finding" this something, as expressed in (1). In the situation described by (2), it is not the relation itself that is the problem but, rather, the task of "determining" this relation, as stated in (2). The situation is similar in (3), (4) and (5). The last of these has an additional mistake, however, which is discussed in Section 5.

102.4 Superfluous use

Often *problem* is used when it is simply unnecessary. The following illustrate this point.

> (1) In order to find the true vacuum configuration, we must solve the minimization problem of the energy functional.
> (1) In order to find the true vacuum configuration, we must minimize the energy functional.
> (2) The T*-product is certainly convenient, because when using it, we need not be concerned with the ordering problem of the field operators.
> (2) The T*-product is certainly convenient, because when using it, we need not be concerned with the order of the field operators.
> (3) For our purposes, it is sufficient to consider the regularization problem of $\mathcal{E}$.
> (3) For our purposes, it is sufficient to consider the regularization of $\mathcal{E}$.
> (4) Observation of this type of behavior for isolated neutron stars is a very difficult problem.
> (4) Observation of this type of behavior for isolated neutron stars is very difficult.
> (4*) It is difficult to observe this type of behavior for isolated neutron stars.

In all of these cases, "problem" adds no meaning, and its inclusion simply results in unnecessarily indirect and awkward sentences.

102.5 Misused with *future*

Expressions containing *problem* and *future* are often used in reference to a topic that is to be considered or investigated in the future. Such expressions should be avoided. To understand this point, let us study the following examples.

> (1) It would also be a future problem to investigate the case in which the topology of the energy contour surface changes.
> (1) It is an important problem to investigate the case in which the topology of the energy contour surface changes.
> (1*) In the future we hope to investigate the case in which the topology of the energy contour surface changes.
> (2) How to incorporate general brane configurations remains as a problem for the future.

(2) It remains to determine how to incorporate general brane configurations.

Note that in both of these cases, the "problem" in question is not something whose existence is confined to the future. Because *problem* means *a task to be carried out*, even when discussing a future investigation involving some problem, it is understood that the problem itself exists in the present.

102.6 Misuse with question words

The misuse of *problem* with question words, as illustrated by the examples given in this section, is quite common.

102.6.1 Missing *of* in use with *how to + [verb]*

We often use *problem* in reference to a clause of the form *how to + [infinitive verb]...*, as in the example below.

(1) The problem of how to define the corresponding quantities is not trivial.

The following demonstrate the mistake I find with this construction.

(2) In general coupled-channel systems, the problem how to choose the rotational angle is not simple.
(2) In general coupled-channel systems, the problem of how to choose the rotational angle is not simple.
(3) They ignore the problem how to represent a continuous world by combining small sub-worlds.
(3) They ignore the problem of how to represent a continuous world by combining small sub-worlds.

In these sentences, "problem" is used in reference to the clauses "how to choose..." and "how to represent..." While (2) and (3) are not grammatically incorrect,[3] they are poor for two reasons. The first reason is that it is somewhat unclear at first reading that "how to choose...angle" and "how to represent...world" are acting as units and that "problem" refers to them. The second reason is that because "problem" can also act as an adjective (and in fact when it appears directly in front of a noun, this is probably the most natural interpretation), these sentences are ambiguous. By inserting "of," both of these problems are solved. It is then clear that "problem" is a noun and that it refers to the "how..." clause, which is now the object of the preposition "of."

[3]The clauses "how to choose..." and "how to represent..." are noun clauses. A noun clause acts grammatically as a noun. In (2), this clause is the subject of the verb, and in (3) it is the object.

102.6.2 Misuse with other types of wh-clauses

Noun clauses introduced by question words are sometimes called 'wh-clauses'. Above we considered the misuse of *problem* with one particular type of wh-clause. Here we treat such clauses more generally. The sentences below provide examples of a very frequently appearing misuse of *problem* in reference to things that are more correctly referred to as *questions*.

> (4) However, what kinds of mesons do really exist is a dynamical problem of QCD.
> (4) However, to determine what kinds of mesons do really exist is a dynamical problem of QCD.
> (4*) However, it is a dynamical problem of QCD to determine what kinds of mesons do really exist.
> (5) Although the behavior of stem cells has been studied extensively, the problem how stem cells determine their fates is still elusive.
> (5) Although the behavior of stem cells has been studied extensively, the /manner in which/the mechanism by which/the process by which/ they determine their fates is still unknown.
> (5*) Although the behavior of stem cells has been studied extensively, the question of how they determine their fates is still unanswered.
> (6) Whether the transition is first order or second order is a non-trivial problem.
> (6) To show whether the transition is first order or second order is a non-trivial problem.
> (7) We now consider the problem of how nonzero masses are generated.
> (7) We now consider the question of how nonzero masses are generated.
> (8) The problem of why this symmetry is preserved has not been solved.
> (8) The question of why this symmetry is preserved has not been answered.
> (9) The problem of why organisms are separated into distinct groups has not yet been fully solved.
> (9) The question of why organisms are separated into distinct groups has not yet been fully answered.

In most cases (with the most common exception being *how to + [verb]...* clauses, considered in the previous section), it is inappropriate to use *problem* in reference to a wh-clause. The reason for this is the following. In accordance with the definitions of *problem* pertaining to mathematics and physics, when that expressed by the wh-clause is not an action that we (that is, human researchers) perform, then the question it poses cannot be thought of as constituting or corresponding to a problem. Indeed, it is usually the case that the verb in a wh-clause does *not* express an action performed by a human.[4] In the above examples, with the verbs "exist," "determine," "is," "are generated," and "is preserved," the wh-clauses describe actions and states of some non-human entities. For example, in (4), although the question "what kinds

[4]Note, by contrast, that often the action expressed in a *how to + [verb]* clause is indeed something that a human performs. Clearly, however, this is not the case for (5) and (7) above.

of mesons do really exist?" expresses a puzzle, the *problem* we face is not this puzzle itself but, rather, the task of solving it. In (4), (4*) and (6), the action that *we* perform has been added. In (5*), (7), (8) and (9), "problem" has been replaced by "question."[5] In (5), a different approach is used.

102.7 Misuse with the verb *answer*

The verb *answer* should never take *problem* as its direct object. In general, we *answer a question* and *solve a problem*. The following is representative of this mistaken usage.

> (1) Of course, this is a difficult problem that cannot be answered in a single paper.
> (1) Of course, this is a difficult problem that cannot be solved in a single paper.
> (1*) Of course, this is a difficult question that cannot be answered in a single paper.

[5]In (8) and (9) this also requires changing "solved" to "answered."

Chapter 103

question

Because their meanings and uses are similar, many of the mistakes involving the nouns *question* and *problem*, treated in the previous chapter, are also similar.

103.1 Misuse in reference to things that are not questions

Although this type of misrepresentative use is not as prevalent with *question* as with *problem*, it is common enough to warrant discussion. The examples below are illustrative.

> (1) One of the deepest questions in science is the boundary of the living state.
> (1) One of the deepest questions in science is /how to define/how to characterize/how to discern/ the boundary of the living state.
> (1*) One of the deepest questions in science regards /defining/characterizing/ discerning/ the boundary of the living state.
> (2) Then, the question becomes to seek a quantity $\tilde{y}$ that satisfies this property.
> (2) Then, the problem becomes finding a quantity $\tilde{y}$ that satisfies this property.

There are two problems with (1). The first is one of semantics. In its present usage, "question" means *a point or subject that remains unanswered or unresolved*. Thus, while there certainly are many questions concerned with "the boundary of the living state," this boundary itself is not something that can be answered or resolved, and therefore it cannot be considered a question. The second problem with the original is that it is vague. It is not clear exactly what it is about the boundary of the living state that the author feels is a deep question. The intended meaning seems to be that expressed by one of the rewritten versions. The second example is similar.

103.2 Superfluous use

As with *problem*, there are many situations in which the use of *question* is superfluous. The following are typical.

(1) However, one may have a question why the energy scale $s = (p_-+p_+)^2$ does not appear in the soft-photon correction.
(1) However, one may ask why the energy scale $s = (p_- + p_+)^2$ does not appear in the soft-photon correction.
(1*) However, it may not be /clear/obvious/evident/apparent/ why the energy scale $s = (p_- + p_+)^2$ does not appear in the soft-photon correction.
(2) We ask the question whether or not these formations are destabilized by the white dwarfs.
(2) We /ask/investigate/ whether these formations are destabilized by the white dwarfs.
(3) It is therefore natural to ask the question why this term can be ignored.
(3) It is therefore natural to ask why this term can be ignored.
(4) It is an unsettled question how to extract the relevant behavior.
(4) It is not known how to extract the relevant behavior.
(5) This may give a clue to the question, "how can we see the singular junction point?"
(5) This may help us to determine how the singular point can be observed.
(6) It is also an important question that whether this assembly is stable.
(6) It is also important to determine whether this assembly is stable.

In each example, "question" adds no meaning, and its use results only in awkwardness. Also note that in (2), "whether or not" is better replaced by "whether" (see Chapter 132), and the use of "clue" in (5) is poor (see Chapter 36).

103.3 Misuse with question words

Problems involving the use of *question* with question words almost always result from the omission of the preposition "of" in the construction *question of + [question word]*. In some situations, *of* need not appear in this construction, but usually it should be included for clarity. The following sentence demonstrates this point.

(1) In the next section we investigate the question when the non-linear term can be ignored.
(1) In the next section we investigate the question of when the non-linear term can be ignored.

Note that the first sentence here is ambiguous. One possible interpretation is that there is some "question" which is investigated in the next section, and this investigation is applicable in the case that (i.e. "when") the non-linear term can be

ignored. With this interpretation, the adverb "when" (or, more precisely, the adverbial clause that it introduces, "when the non-linear...") is understood as modifying the verb "investigate." However, the intention here is to use "when" as a relative adverb, introducing a relative clause that refers to "question." The meaning that results from this interpretation is expressed unambiguously by (1). Here, it is clear that "question" and "why the non-linear...ignored" represent the same thing.[1]

The following provide further examples.

> (2) We look for an answer to the question how such a biochemical network is selected.
> (2) We look for an answer to the question of how such a biochemical network is selected.
> (2*) We /seek/attempt/ to determine how such a biochemical network is selected.
> (3) We would like to investigate the question how commutativity can be restored.
> (3) We would like to /investigate/address/ the question of how commutativity can be restored.
> (3*) We would like to determine how commutativity can be restored.
> (4) Several authors have provided answers to the question where this method can be applied.
> (4) Several authors have provided answers to the question of where this method can be applied.
> (4*) Several authors have found where this method can be applied.
> (4**) Several authors have found applications for this method.

In (2) and (3), "how" is meant to be used as an adverb, introducing a noun phrase, but it could be interpreted as a conjunction with the meaning *the manner in which*. Thus, for example, (2) could be construed as meaning that we look for the answer to some "question," and the manner in which we look for it is such that a biochemical network is selected. While the intended meaning of (4) is expressed by (4), it could also be interpreted as meaning that several authors have provided answers to some question, and these answers are meaningful "where" (i.e., in the case that) the method in question can be applied. The simplest corrections of the originals are given by (2), (3) and (4), but the forms of expression in (2*), (3*), (4*) and (4**) are clearly more elegant.

[1]In (1), the clause "when...ignored" is clearly a noun clause, which acts grammatically as any other noun. Hence there is no grammatical problem with the following sentence: *In the next section we investigate when the non-linear term can be ignored.* (Here, the clause "when...ignored" acts as the direct object of the verb "investigate.") However, there are two problems of a different nature in this case. First, this sentence is ambiguous. One possible (although somewhat unnatural) interpretation is that *something* is investigated in the next section, and this investigation regards the case in which the non-linear term can be ignored. Second, this sentence is awkward. As demonstrated here, generally it is best to avoid using such a long clause as the subject or object of a verb, because this usually results in clumsiness. For these reasons, it is best to use the construction in (1), with "question" acting as the direct object.

103.4 Misuse with the verb *solve*

As mentioned in the previous chapter, we *solve a problem* and *answer a question*.

(1) To analyze this phenomenon more precisely, we need to solve several questions.
(1) To analyze this phenomenon more precisely, we need to answer several questions.
(1*) To analyze this phenomenon more precisely, we need to solve several problems.

103.5 Further examples

Below I give a number of additional examples demonstrating various types of misuse of *question*.

(1) As mentioned above, there is an open question how that this delicate balance is maintained.
(1) As mentioned above, there is an open question of how this delicate balance is maintained.
(2) We investigate the basic question of "what is the complete set of rational actions?"
(2) We address the basic problem of determining the complete set of rational actions.
(3) There are several interesting questions, such as "what effect do the game dynamics have on the evolution of strategies?"
(3) There are several interesting questions. For example, what effect do the game dynamics have on the evolution of strategies?
(4) We attempt to answer the question "why is the top quark far heavier than the bottom quark?"
(4) We attempt to determine why the top quark is far heavier than the bottom quark.
(4*) We address the question of why the top quark is far heavier than the bottom quark.
(5) An interesting question remaining here is that whether the stochastic differentiation depends on the interactions described above.
(5) An interesting question remaining here is whether the stochastic differentiation depends on the interactions described above.
(6) Some may cast a question why we select such a complicated system.
(6) One may /ask/wonder/ why we select such a complicated system.
(7) The question by Holmes why these terms cancel is answered.
(7) We answer the question of why these terms cancel, which was posed by Holmes.
(7*) We show why these terms cancel, which is a question posed by Holmes.
(8) The question "How such a simple model could describe our real world?" is still elusive.

(8) It is still not known how such a simple model can describe our real world.
(9) The question how such a biochemical network is selected remains unanswered.
(9) The question of how such a biochemical network is selected remains unanswered.
(9*) It is still not known how such a biochemical network is selected.
(10) An important question is: how the gauge symmetry at the microscopic level reflects this structure?
(10) It is important to determine how the gauge symmetry at the microscopic level reflects this structure.
(10*) We pose the following important question: How does the gauge symmetry at the microscopic level reflect this structure?
(11) The difficult question is, "Can we observe this behavior in human activities?"
(11) The difficult question is whether we can observe this behavior in human activity.
(11*) The difficult problem is to determine whether we can observe this behavior in human activity.
(12) Then question may arise. Does there exist the universally best strategy?
(12) Then we ask, Does there exist a universally best strategy?

Chapter 104

real

There are two types of misuse of *real* that require some attention.

104.1 Misused to mean *actual*

It is usually best not to use the adjective *real* when the intended meaning can be expressed by *actual*. This is particularly true in mathematical discussion. There are two reasons to avoid *real* in such situations. First, there is sometimes the danger that it will be misunderstood as referring to real numbers. Second, *real* can sound somewhat informal when used as a synonym of *actual*. The following illustrate this problematic use.

> (1) This behavior of our discretized model corresponds to a real divergence in the original.
> (1) This behavior of our discretized model corresponds to an actual divergence in the original.
> (2) However, the real size distribution may be different from the ideal Gaussian distribution.
> (2) However, the actual size distribution may be different from the ideal Gaussian distribution.

Before moving on, I note that the consideration here should be understood as applying mainly to mathematical discussion. In reference to physical phenomena or entities, the use of *real* addressed in this section is often quite appropriate. As just a few examples, the expressions *real physical behavior*, *real neurons* and *real clusters of galaxies* are very natural.

104.2 Misused as an adverb

Although *real* can be used as an adverb (as a synonym of *truly* or *very*), this usage is quite colloquial and should be strictly avoided in written work. The following are typical.[1]

[1] As the examples in this section illustrate, in scholarly papers, *real* should not be used to express the meaning of 本当に.

(1) This is a real global effect.
(1) This is a truly global effect.
(2) We found a real large discrepancy.
(2) We found a /very/quite/ large discrepancy.
(3) However, this method is plagued by several real serious philosophical problems.
(3) However, this method is plagued by several /truly/very/quite/ serious philosophical problems

Chapter 105

really

The adverb *really* is very informal, and it should not be used in written work.[1] The following are some of the expressions in place of which I sometimes find *really* inappropriately used: *actually*, *truly*, *certainly*, *undoubtedly*, *indeed*, *in fact*, *genuinely*, *very*, *quite*, *greatly*, *considerably*, *substantially*, *significantly*, *utterly*, *altogether*, *extremely*, *extensively*, *to a great extent*. Below I give some representative examples.

> (1) It is important to determine if this is really true.
> (1) It is important to determine if this is /actually/indeed/ true.
> (2) This is a really large value.
> (2) This is /a very/an extremely/ large value.
> (3) But it remains to be seen if this is really the case.
> (3) But it remains to be seen if this is /actually/indeed/in fact/ the case.
> (4) This is really a difficult problem.
> (4) This is a /truly/genuinely/very/extremely/quite/ difficult problem.
> (5) But it may be the case that this is really unknowable.
> (5) But it may be the case that this is /truly/actually/in fact/genuinely/ unknowable.

[1] Although *really* can be used to express the meanings of 本当に, 実際に, とても and 全く, among other expressions, all such uses are quite conversational.

Chapter 106

reason

In the following sections I discuss the ways in which the noun *reason* is most frequently misused.

106.1 Misused with *because of*, *due to* and related expressions

106.1.1 Acting as the object of the preposition

One of the most common misuses of *reason* is demonstrated by the following.

(1) We did not investigate the system below T_c because of two reasons.
(1) We did not investigate the system below T_c for two reasons.
(1*) There are two reasons that we did not investigate the system below T_c.
(2) This discrepancy should be examined in more detail because of two reasons.
(2) This discrepancy should be examined in more detail for two reasons.
(2*) There are two reasons that this discrepancy warrants further examination.
(3) There is some confusion regarding terminology due to historical reasons.
(3) There is some confusion regarding terminology that is due to historical circumstances.
(4) Due to the reasons mentioned above, it is difficult to explain the observed spindown with the present model.
(4) For the reasons mentioned above, it is difficult to explain the observed spindown with the present model.
(4*) Due to the /problems/complications/effects/ mentioned above, it is difficult to explain the observed spindown with the present model.
(5) Each of these transitions /is caused by/results from/ a different reason.
(5) Each of these transitions has a different cause.

(5*) Each of these transitions /is caused by/results from/ a different /effect/mechanism/process/.

Each of the original sentences above has a problem of meaning. This problem is that, logically, the expressions *due to*, *because of*,[1] *is caused by* and *results from* point to a *source* from which some effect, fact or situation originates, while a *reason* is a fact or cause that implies or leads (logically or causally) to some conclusion or result. Thus, although such a source can be that from which a reason is derived, these are logically two fundamentally different types of things. In the above original sentences, however, the manner in which "reason" is used with "due to," "because of," etc., implies that these reasons constitute sources of the type described above.

106.1.2 Acting as the subject

As stated above, the noun *reason* refers to a fact or cause that implies or (logically or causally) leads to some conclusion or result. However, I sometimes find it used in the opposite role, that is, as the conclusion or result of some other fact or cause. The following are typical.

(6) The reason that this calculation is non-trivial in the present case is due to the spatial inhomogeneity of the system.
(6) The fact that this calculation is non-trivial in the present case /is due to/results from/follows from/ the spatial inhomogeneity of the system.
(6*) The reason this calculation is non-trivial in the present case is that the system is spatially inhomogeneous.
(6**) The non-trivial nature of the calculation in the present case /is due to/results from/ the spatial inhomogeneity of the system.
(7) The reason that these terms no longer cancel results from the anisotropy.
(7) The fact that these terms no longer cancel /results from/is due to/ the anisotropy.
(7*) The present situation in which these terms no longer cancel /results from/is due to/ the anisotropy.
(8) The reason for these few types of cells is due to the simplicity of the chemical reaction network we chose.
(8) The reason there are only a few types of cells is that we chose a simple chemical reaction network.
(8*) The fact that there are only a few types of cells /is due to/results from/can be attributed to/ the simplicity of the chemical reaction network we chose.
(9) The reason for this divergence is due to the long tail of Γ.
(9) This divergence /is due to/results from/is caused by/ the long tail of Γ.

Interpreted literally, the original sentences here seem to be describing reasons for reasons. In (6*) and (8), "reason" correctly refers to the facts that "the system

[1] For more detailed discussion of the misuse of *reason* with *because of*, see Section 1 of Chapter 26.

is spatially inhomogeneous" and "we chose a simple chemical reaction network." Note that each of these is a complete idea, whose expression requires a finite verb. Discussion related to this point is given in Section 4.

106.2 Misused with *attribute*

Statements in which *reason* acts as the object of the verb *attribute* (or the subject of the passive form of this verb) are semantically problematic. Consider the following.

> (1) The reason for this mass difference is usually attributed to the tensor interaction of the one-gluon exchange potential.
> (1) This mass difference is usually attributed to the tensor interaction of the one-gluon exchange potential.
> (2) The reason that this force is capable of accounting for the binding energy of He isotopes is attributed to this effect of the strong LS force.
> (2) The fact that this force is capable of accounting for the binding energy of He isotopes is attributed to this effect of the strong LS force.
> (3) We attribute the reason for this behavior to the sudden change in sign of τ.
> (3) We attribute this behavior to the sudden change in sign of τ.
> (3*) We believe that the reason for this behavior is the sudden change in sign of τ.
> (3**) We believe that this behavior is due to the sudden change in sign of τ.

Because the verb *is attributed* is very close in meaning to *is due to* and *is because of*,[2] the problems in (1)–(3) are essentially the same as those in (6)–(9) in the previous section. Like those examples, the originals above seem to be expressing the reasons for reasons.

106.3 Redundant use

The following example appears to be similar to (6)–(9) of Section 1, but in fact, the problem here is of a different nature.

> (1) The reason for the divergence of the integral in this case is because for $\gamma > \alpha/2$, the prefactor $f(s)$ no longer decays more quickly than $1/s$.
> (1) The reason for the divergence of the integral in this case is that for $\gamma > \alpha/2$, the prefactor $f(s)$ no longer decays more quickly than $1/s$.
> (1*) The integral diverges in this case because for $\gamma > \alpha/2$, the prefactor $f(s)$ no longer decays more quickly than $1/s$.

The conjunction *because* means *for the reason that.* Hence, in contrast to *because of*, that which *because* introduces does indeed constitute a reason. Therefore, the problem with (1) is redundancy: Both "reason...is" and "because" indicate that "the prefactor...$1/s$" expresses a reason.

[2]More precisely, it means *is regarded as being due to.*

106.4 Mistaken reference to a noun with *reason*

Usually, something regarded as a reason consists of a complete idea that is, in general, expressed by a finite clause (i.e. a clause with a finite, or 'main', verb). It is best to avoid use of *reason* in reference to other types of expressions. This type of mistake is particularly common with nouns.

> (1) One of the reasons for this behavior is the above stated properties of the anomaly-free $U_R^{AF}(1)$ symmetry.
> (1) One of the /causes/sources/ of this behavior is the above stated properties of the anomaly-free $U_R^{AF}(1)$ symmetry.
> (1*) One of the reasons for this behavior is that the anomaly-free $U_R^{AF}(1)$ symmetry possesses the above stated properties.
> (2) The reason for the overestimation by Robbi et al. could be their method of approximation for the nuclear density distribution.
> (2) The /cause/source/ of the overestimation by Robbi et al. could be their method of approximation for the nuclear density distribution.
> (2*) The overestimation by Robbi et al. could /be caused by/result from/be due to/ their method of approximation for the nuclear density distribution.
> (2**) The reason for the overestimation by Robbi et al. could be that their method of approximation for the nuclear density distribution is /poor/inappropriate/.
> (3) This problem occurs for several reasons, including an inappropriate beam diameter.
> (3) There are several causes of this problem, including an inappropriate beam diameter.

In each of the original examples here, "reason" is used incorrectly in reference to a noun: in (1) to "properties," in (2) to "method," and in (3) to "diameter." Contrastingly, in (1*) and (2**), the "reason" in question is stated as the facts that "the anomaly-free...properties" and "their method...poor." Both of these are finite clauses, with the finite verbs "possesses" and "is."

106.5 Misused with *by*

In general, *reason* cannot act as the object of the preposition *by*. Often I find *by* used in this role in place of *for*. This misuse is exemplified by the following.[3]

> (1) By these reasons, we conclude that φ_0 is indeed the eigenfunction with the smallest value of ω.
> (1) For these reasons, we conclude that φ_0 is indeed the eigenfunction with the smallest value of ω.

[3]The erroneous use of *by* with *reason* apparently results from the direct translation of, for example, この理由で as *by this reason*. Here, で cannot be translated as *by*.

Chapter 107

relative

There are two ways in which I find the adjective *relative* misused.

107.1 Misused to mean *ratio*

Expressions like *relative value* and *relative size* are often incorrectly used in the comparison of two quantities. Usually when they are used in this role, the intended meaning is that of *ratio*. This problem is exemplified by the sentence below.

> (1) The relative strength of the contributions, $\rho_{(1,0)}/\rho_{(-1,0)}$, increases in this case.
> (1) The ratio of the strengths of the contributions, $\rho_{(1,0)}/\rho_{(-1,0)}$, increases in this case.
> (1*) The ratio of $\rho_{(1,0)}$ to $\rho_{(-1,0)}$ increases in this case.

The misconception reflected by the author's use of the term "relative strength" in reference to the ratio of these two contributions is very widespread among Japanese scholars. It must be realized that, in general, when we are considering two quantities a and b, their 'relative value' is not a pre-defined mathematical concept, and without specifically defining it, the reader will not know what is meant by such a term. In particular, this will not be understood as representing the ratio of a to b.

Although when used in reference to two quantities, such phrases as *relative value*, *relative strength*, etc., do not express well-defined meanings, when used in reference to a single quantity, as demonstrated by the following, they are meaningful.

> (2) The relative magnitude of τ is quite large.

In this sentence, the adjective "relative" indicates that the magnitude of τ is being compared to the magnitude of some other (unstated) quantity, which serves as a standard, and its use implies that it is with respect to this standard that the magnitude of τ is considered large. Thus the above sentence is identical in meaning to the following.

> (2′) The magnitude of τ is quite large, relatively.

In both (2) and (2′), the implication is that there is some understood benchmark to which the magnitude of τ is being compared.

The following is another typical example of the misuse of *relative*.

> (3) The eigenvalues $\alpha^{2n}_{N_0}$ and $\beta^{2n}_{N_0}$ are equal at $k = 0$, but they are unequal for $k > 0$, though we do not know their relative magnitude as a function of k.
>
> (3) The eigenvalues $\alpha^{2n}_{N_0}$ and $\beta^{2n}_{N_0}$ are equal at $k = 0$, but they are unequal for $k > 0$, though we do not know their /difference/ratio/relation/ as a function of k.

Here, the intended meaning of the term "relative magnitude" in the original is unclear. It seems that this meaning is expressed by one of the terms used in its place in (3), although there are other possibilities. Among these terms, "relation" is the most general (and hence the most vague).

107.2 Misused with *sign*

The following exemplifies the manner in which *relative* is misused with the noun *sign*.

> (1) The behavior of the mixing matrix depends on the relative sign of m_1 and m_2, as well as their absolute values.

The main problem with this sentence is that the expression "relative sign" is meaningless. It seems that the intention here is to state that the mixing matrix depends on whether m_1 and m_2 are of the same or opposite sign. If this is indeed the case, then the following is probably the best choice.

> (1) The behavior of the mixing matrix depends on the sign of $m_1 m_2$, as well as on $|m_1|$ and $|m_2|$.

One further (but somewhat unlikely) possibility here is that m_1 and m_2 are complex quantities and the intention is to state that their phases differ by π. If this is the case, however, this statement should be made in terms of phases rather than signs.

Chapter 108

remarkable

108.1 Inappropriate use

In the papers I proofread, in almost all instances that the adjective *remarkable* appears, the intended meaning could be more appropriately expressed by some other term. In most of these cases, *remarkable* is used as a synonym of either *noteworthy* or *significant*. Although *remarkable* does possess such meanings, it also necessarily carries a meaning like *extraordinary* or *unusual*.[1] When this latter meaning is inappropriate, *remarkable* should not be used.

The examples below are typical of the improper use of *remarkable* that I encounter.

> (1) Above we found that $\rho(\alpha)$ is non-negative for all values of α. This is a remarkable result.
> (1) Above we found that $\rho(\alpha)$ is non-negative for all values of α. This is a /noteworthy/interesting/significant/ result.
> (2) Palini's theorem represents a remarkable contribution.
> (2) Palini's theorem represents an /important/significant/ contribution.
> (3) Among these nuclei, ${}^{8}_{5}B_3$ is remarkable.
> (3) Among these nuclei, ${}^{8}_{5}B_3$ is /particularly noteworthy/worthy of special note/particularly interesting/.
> (4) The width of the ordinary emission band has no remarkable dependence on the two-photon excitation energy.
> (4) The width of the ordinary emission band has no /significant/prominent/conspicuous/marked/ dependence on the two-photon excitation energy.
> (4*) The width of the ordinary emission band does not depend strongly on the two-photon excitation energy.
> (4**) The width of the ordinary emission band depends only weakly on the two-photon excitation energy.
> (5) The fits of the theoretical curves to the experimental data presented

[1]There seems to be a widespread misunderstanding that *remarkable* corresponds to 注目すべき. In fact, in general, it is used to express meanings closer to 驚くべき, びっくりするほどの and 珍しい. As stated in The American Heritage Dictionary of the English Language [1], "*Remarkable* describes what elicits comment because it is unusual or extraordinary."

in Fig. 1 are remarkable.
(5) The fits of the theoretical curves to the experimental data presented in Fig. 1 should be noted.
(5*) As seen in Fig. 1, the theoretical curves and experimental data are everywhere consistent.
(6) There is no remarkable isotope effect.
(6) There is no /significant/strong/prominent/observable/marked/ isotope effect.
(6*) The isotope effect is weak.
(7) A remarkable feature of their variational approach is that the calculated lower bound is a good approximation of the exact partition function.
(7) /An important/A noteworthy/A notable/ feature of their variational approach is that the calculated lower bound is a good approximation of the exact partition function.
(8) There is a remarkable variability in the sizes of the developed colonies.
(8) There is a /significant/very large/conspicuous/ variability in the sizes of the developed colonies.
(9) This phenomenon becomes remarkable as the frequency increases.
(9) This phenomenon becomes /conspicuous/pronounced/prominent/ noteworthy/ as the frequency increases.

In each of the original sentences here, use of "remarkable" results in an inappropriately strong assertion. Although *remarkable* can be interpreted with different shades of meaning, the connotation of *extraordinary* is always present.[2] In scholarly writing, it is best to make such strong assertions very sparingly. Example (1) illustrates particularly problematic usage. Because this statement is in reference to the author's own work, it appears to be self-congratulatory. In (2), the assertion seems to be that the contribution of Palini's theorem is highly exceptional. Of course, this is possible, but unless this contribution truly transcends the level of even important works, it is better to use something more reserved, like "important" or "significant." Example (3) is simply strange. Use of "remarkable" in (4) results in ambiguity. Here it is not clear if the author meant to assert that this dependence is weak or just that it is not strong. Example (5) is especially problematic. Here, even *noteworthy* and *significant* would be inappropriate. Clearly, (6) is similar to (4). The use of "remarkable" in (7) results in what is obviously an overstatement. Perhaps the least problematic of these examples is (8), but here too, the rewritten versions are somewhat better than the original. The problem in (9) is quite serious.

The following are some of the expressions that can be used in place of *remarkable*: *noteworthy*, *worthy of note*, *worth noting*, *notable*, *interesting*, *important*, *significant*, *noticeable*, *observable*, *marked*, *conspicuous*, *prominent*, *pronounced*. These terms all lack the strong meaning carried by *remarkable*.

[2] Indeed, according to the Oxford English Dictionary [4], the only present-day definition of this word includes the meaning of *extraordinary*.

108.2 Appropriate use

The following is an example of a proper use of *remarkable*.

> (1) The last several decades have witnessed a remarkable increase in the processing speed of computers.

In this case, the intended meaning indeed seems to be that this increase has been extraordinary. It would be possible to replace "remarkable" here with *great*, which is weaker, but not inappropriate. However, *significant*, *noteworthy* and the other words listed above would probably be too weak.

Chapter 109

research

109.1 Inappropriate use

In general, the word *research*, in both noun and verb forms, is overused by Japanese authors in scientific works. In most cases that I find this word used, it would be better replaced by *study/study*, *investigation/investigate*, *examination/examine*, *inquiry/inquire*, *analysis/analyze* or *treatment/treat*.[1] The following are typical examples.

> (1) We have researched the above equation and found that in fact it exhibits at least two of the three bifurcations discussed above.
> (1) We have /studied/investigated/analyzed/ the above equation and found that in fact it exhibits at least two of the three bifurcations discussed above.
> (2) We propose to research much larger molecules using the same experimental method.
> (2) We propose to /study/investigate/examine/analyze/treat/ much larger molecules using the same experimental method.
> (3) There are several previous researches of gel systems that are particularly relevant.
> (3) There are several previous /studies/investigations/analyses/treatments/ of gel systems that are particularly relevant.
> (4) In most researches on such systems, it is assumed that the inertial term can be treated perturbatively.
> (4) In most /studies on/investigations of/ such systems, it is assumed that the inertial term can be treated perturbatively.

In comparison with the words listed above, within the context of scientific and other scholarly writing, *research* is applied in more general (as opposed to concrete and specific) situations and usually with regard to relatively long-term projects. For this reason (1) sounds very unnatural. By contrast, the following is quite natural.

[1] In most situations, one of these words is more appropriate than *research* to express the meaning of 研究.

(5) As a representative of one particular type of system to which our research applies, we have studied (1.2) and found that in fact it exhibits at least two of the three bifurcations discussed above.

Here, the verb "study" is used in reference to the actual investigation of a specific equation, while the noun "research" refers to a more general investigation that includes the study of this particular equation as one application.

The use of "research" in the second example, while not as unnatural as that in the first, also is somewhat problematic. Here too, the scope of the study in question would appear to be too specific to be termed "research." According to this statement, the nature of the proposed study is already fairly well-defined, apparently consisting of the application of an established experimental method. This sentence creates the image of a straightforward procedure of simply repeating the previous study in a new setting. While the actual task is undoubtedly much more complicated, the impression that the reader gets is that of an almost mechanical execution of the prescribed steps. It is best to reserve use of *research* for more open-ended and less clearly delineated investigations of a more general context. For example, in (2), if we deleted the qualifying expression "using the same experimental procedure," the resulting sentence would be quite natural.

The third and fourth examples above make this general-versus-specific distinction more clear. The problem here is that "researches" is being used in reference to individual, specific investigations.

109.2 Appropriate use

As illustrated by (5) in the previous section, in the context of scholarly activity, *research* is most naturally used in reference to a long-term project of an abstract nature (possibly without clear delineation) that encompasses many specific studies. The following illustrate further proper uses.

(1) We hope that this paper stimulates further research in this field.
(2) The objective of such research is to gain an understanding of general processes of evolutionary phenomena through computer experiments.
(3) The nature of biological research has changed greatly in the last twenty years.
(4) Her lifelong research has focused on the order Anura, and particularly, the family Bufonidae.
(5) In their researches of meteorological phenomena in a great variety of climates, Yizak and Forbes began to find unmistakable patterns appearing in unexpected ways.
(6) He spent many years researching the effects of this class of drugs on neurological activity.
(7) There is now a large group of people researching the many aspects of global warming.

Note that in (1)–(4), "research" is an uncountable noun. This reflects its general and abstract meaning. In (5), it is used as a countable noun, but here it is clear that

each of these individual “researches” (corresponding to each of the “great variety of climates”) is itself of a large scale and broad scope. The verb “researching” in (6) and (7) refers to activity carried out in a wide range of contexts and over a long period of time.

Chapter 110

rest

The noun *rest* (with the meaning of *the part left over* or *that remaining*) is often misused as an adjective. In such situations, it should be replaced by *rest of* or *remaining*, as illustrated by the following.

(1) The rest equations can be solved similarly.
(1) The /rest of the/remaining/ equations can be solved similarly.
(2) We list the rest twelve marginal operators below.
(2) We list the remaining twelve marginal operators below.

In (1), "rest" is used correctly as a noun. In (1) and (2), "remaining" is a participle (i.e., a verb form acting as an adjective).

A particularly common misuse of *rest* is in the erroneous expression *rest part(s)*. The examples below are typical.[1]

(3) For the rest part of the paper, we focus on (1).
(3) For the /rest/remainder/ of the paper, we focus on (1).
(4) The rest part of the map, $\hat{I}$, can be reduced to the following:
(4) The remaining part of the map, $\hat{I}$, can be reduced to the following:
(5) Each function $f_n(x)$ is divided into the SCS part and the rest parts.
(5) Each function $f_n(x)$ is divided into the SCS part and /the remainder/remaining parts/.

[1] This misuse clearly results from the direct translation of 残余 or 残部.

Chapter 111

same

The adjective/adverb *same* is quite often misused by Japanese authors. Here I treat the most serious types of misuse.

111.1 Used with *as*

The words *same* and *as* are often used together. In this section I consider such use.

111.1.1 Proper use

There are many ways in which *same* can be used with *as*. In simple grammatical terms, we can consider four cases, that in which *as* acts as a preposition, a conjunction, a relative pronoun and a relative adverb. These four cases are illustrated below.

preposition

(1) This shade of blue is the same as that (shade of blue).

conjunction

(2) This wine tastes almost the same as the expensive one (tastes).
(3) He plays the trumpet the same as a great tenor sings.

relative pronoun

(4) I read the same book as you (read).
(5) Today you spent the same amount as yesterday you earned.

relative adverb

(6) I grew up in the same town as you (grew up).
(7) I heard the bell today at the same time as (I heard it) yesterday.

The words in parentheses here would generally not be included in such sentences, and their meanings would be implied.[1] Although the above examples essentially represent all the grammatical possibilities involving *same* and *as*, in order to understand the problems treated in this section, it is more useful to consider their usage in the structural terms discussed below.

First, let us reconsider the above examples. Note that in (1), we have the basic construction *[noun 1] + is the same as + [noun 2]*, where *[noun 1]* and *[noun 2]* represent things of the same type. In (2) and (3), the basic construction is *[expression 1] + the same as + [expression 2]*, where *[expression 1]* and *[expression 2]* have parallel meanings and (including the parenthetic "tastes") nearly identical grammatical structures. In (4)–(7), we have *[expression 1] + the same + [noun] + as + [expression 2]*, where, again, *[expression 1]* and *[expression 2]* have parallel meanings and (including the parenthetic phrases) nearly identical grammatical structures.[2] The construction in (1) compares *[noun 1]* and *[noun 2]*, that in (2) and (3) compares those things described in *[expression 1]* and *[expression 2]*, and that in in (4)–(7) compares those things described in *[expression 1]* and *[expression 2]* with respect to *[noun]*. The following sentences demonstrate two additional possibilities.

(8) The theme of this song is the same in the beginning as in the end.
(9) I had the same wine today as yesterday.

Here, the basic constructions are *[expression] + the same + [case 1] + as + [case 2]* and *[expression] + the same + [noun] + [case 1] + as + [case 2]*, where in each of these, *[case 1]* and *[case 2]* are of the same type.[3] These constructions compare two cases regarding that which is described in *[expression]* (in the second case with respect to *[noun]*). Although there are some exceptions, generally the proper use of *same* and *as* involves one of these five constructions. For convenience I list them below.

(i) *[noun 1] + is the same as + [noun 2]*,
(ii) *[expression 1] + the same as + [expression 2]*,
(iii) *[expression 1] + the same + [noun] + as + [expression 2]*,
(iv) *[expression] + the same + [case 1] + as + [case 2]*,
(v) *[expression] + the same + [noun] + [case 1] + as + [case 2]*.

111.1.2 Improper use

The following examples demonstrate awkward use of *same* and *as*.

[1] Note that in (1) and (4)–(7), "same" acts as an adjective (modifying the nouns "shade," "book," "amount," "town" and "time"), and in (2) and (3) it acts as an adverb (modifying the verbs "tastes" and "plays"). In (1), the prepositional phrase "as...blue" modifies "same." In both (2) and (3), "as" introduces an adverbial clause that modifies "same." In (4)–(7), the relative clauses introduced by "as" refer to the nouns modified by "same."

[2] It should be noted that often in the case of this type of construction, there appears in *[expression 1]* a preposition that does not appear in *[expression 2]*. This is demonstrated by (6), (7), (21), (22) and (24) of this section.

[3] In both (8) and (9), "same" is an adjective (modifying "theme" and "wine"), and "as" is a conjunction.

(10) The action reduces to the same form as the Abelian case.
(10) The action reduces to the same form in this case as in the Abelian case.
(11) This is the same model as that analyzed by Webber and Stevens.
(11) This is the model analyzed by Webber and Stevens.
(11*) This model is the same as that analyzed by Webber and Stevens.
(11**) This is the same as the model analyzed by Webber and Stevens.
(11***) This is /precisely/identical to/ the model analyzed by Webber and Stevens.
(12) This set plays the same role as that of the set Ω.
(12) This set plays the same role as the set Ω.
(12*) The role of this set is the same as that of the set Ω.
(12**) This set and the set Ω play the same role.
(13) We use the same notation as that in Ref. [1].
(13) We use the same notation as Ref. [1].
(13*) We use the notation introduced in Ref. [1].
(14) The same function $U(x)$ as in (3.1) also appears in (5.1).
(14) The function $U(x)$ appearing in (5.1) is the same as that appearing in (3.1).
(15) The definition of τ here is the same one as in Ref. [2].
(15) The definition of τ here is the same as that in Ref. [2].

In each of the original sentences here, *same* and *as* are used in a mistaken construction, and the result is an awkward and confusing statement. The simplest interpretation of (10) is that it employs construction (iv), as *[The action reduces to] the same [form] as [the Abelian case]*. With this interpretation, "form" and "the Abelian case" are considered two types of *cases*. However, this is clearly not the intention of the author. Although there are other possibilities, the intended meaning is probably most clearly expressed by the proper use of (iv) demonstrated in (1). The construction used in (11) is a mistaken form of construction (i): *[This] is the same [model] as [that analyzed by Webber and Stevens]*. Here, "model" is superfluous. Correct applications of construction (i) are demonstrated in (11*) and (11**). Also note that here, as shown in (11) and (11***), the intended meaning can be expressed without using *same*. The construction in (12) is *[This set plays] the same [role] as [that of the set Ω]*. Clearly, this is a mistaken use of construction (iii), as "This set plays" and "that of the set Ω" are parallel in neither meaning nor grammar. The intended meaning is expressed in (12) with construction (iii) (*[This set plays] the same [role] as [the set Ω (plays)]*) and in (12*) with construction (i) (*[The role of this set] is the same as [that of the set Ω]*). Another possibility is demonstrated by (12**). Again, (13) illustrates an improper variant of construction (iii): *[We use] the same [notation] as [that in Ref. [1]]*. In (13), we have *[We use] the same [notation] as [Ref. [1] (uses)]*, which is a correct use of construction (iii). In (14), the construction again appears to be a mistaken form of (iii). The rewritten form in (14) contains construction (i). Example (15) employs a mistaken form of construction (i), while (15) employs its corrected form.

111.1.3 Missing *as*

Sometimes I find *as* erroneously omitted, as in the following.

(16) This is essentially the same plot in Fig. 1.
(16) This is essentially the same plot as in Fig. 1.

111.1.4 Additional examples demonstrating proper use of *same* with *as*

Below I give a few additional examples in which *same* and *as* are used correctly together.

(17) I received the same grade as you.
(18) I will be here at the same time as yesterday.
(19) I did this the same way as you.
(20) The way that he looks at you is not the same as the way that he talks to you.
(21) My brother is in the same line of business as you.
(22) I do not look at things in the same way as you.
(23) The pie at this restaurant does not taste the same as it used to.
(24) This is done according to the same rules as before.

The constructions employed in these sentences are as follows: in (17), *[I received] the same [grade] as [you (received)]*, construction (iii); in (18), *[I will be here at] the same [time] [(today)] as [yesterday]*, construction (v); in (19), *[I did this] the same [way] as [you (did this)]*, construction (iii); in (20), *[The way that he looks at you] is not the same as [the way that he talks to you]*, construction (i); in (21), *[My brother is in] the same [line of business] as [you (are)]*, construction (iii); in (22), *[I do not look at things in] the same [way] as [you (look at things)]*, construction (iii); in (23), *[The pie at this restaurant does not taste] the same as [it used to (taste)]*, construction (ii); in (24), *[This is done (now) according to] the same [rules] as [(it was done) before]*, construction (iii).

111.2 Superfluous use

The following illustrate situations in which *same* is used unnecessarily.

(1) Applying the same procedure as described above leads to the following:
(1) Applying the procedure described above leads to the following:
(2) We need the same parameterization as that listed in Table 1.
(2) We need the parameterization listed in Table 1.
(3) The same effect as that at weak coupling is also observed at strong coupling.
(3) The effect observed at weak coupling is also observed at strong coupling.
(4) We again obtain the same expression as (3.1).

(4) We again obtain the expression in (3.1).
(5) In the present case, this approach shares the same merits as the conventional approach.
(5) In the present case, this approach has the same merits as the conventional approach.
(5*) In the present case, this approach shares the merits of the conventional approach.
(6) This can be done using the same function F as defined in Eq. 1.
(6) This can be done using the function F defined in Eq. 1.
(7) In the same procedure as presented in Sec. 1, this is easily proved.
(7) /Using/With/ the procedure presented in Sec. 1, this is easily proved.
(8) We now repeat the same analysis as in Sec. 3.
(8) We now repeat the analysis of Sec. 3.
(9) As is the same in the 1-d case, the computation fails to converge here.
(9) As in the 1-d case, the computation fails to converge here.
(10) This is done the same as in the previous case.
(10) This is done as in the previous case.
(10*) This is done in the same manner as in the previous case.
(11) In the same way as discussed in Sec. 1, we can show that $\alpha = 2$ for any set of initial conditions with bounded support.
(11) /In the manner/Using the method/ discussed in Sec. 1, we can show that $\alpha = 2$ for any set of initial conditions with bounded support.
(12) We calculate in the same way as in the case of linear motion.
(12) We perform a calculation similar to that in the case of linear motion.
(12*) We again employ the calculation performed in the case of linear motion.
(12**) We follow the calculational procedure used in the case of linear motion.
(13) In the same way as in Ref. [5], we use Lebesgue integration to derive the result.
(13) /As in/In analogy to/Using the method of/Following/ Ref. [5], we use Lebesgue integration to derive the result.
(14) The desired result can be derived most simply by using the same approach as that in Ref. [2].
(14) The desired result can be derived most simply with the approach used in Ref. [2].
(15) This was determined by the same manner that Field et al. used.
(15) This was determined using the /approach/method/ of Field et al.
(15*) This was determined in the manner demonstrated by Field et al.
(16) This expression contains all the important terms, including the same ones derived by Smith.
(16) This expression contains all the important terms, including those derived by Smith.
(17) By the same argument in Ref. [7], the following relations hold:
(17) By an argument given in Ref. [7], it can be shown that the following

relations hold:
(17*) /Using/Applying/ an argument given in Ref. [7], it can be shown that the following relations hold:

In each of the original sentences here, "same" is not needed to express the desired meaning of sameness. Its use results in redundant and quite awkward statements. Particular attention should be given to (5), because such redundant use of "same" with "shares" is very common. (Note that *share* expresses the meaning *possess the same.*) In addition to the problem of redundancy, all but two of the above original examples that employ "same" with "as" do so improperly. (In (5) we have *[this approach shares] the same [merits] as [the conventional approach (shares)]*, which is a proper use of construction (iii). Note that (5) employs the same structure, simply omitting "share." The construction in (12) is *[We calculate (here) in] the same [way] as [(we calculated) in the linear case]*, which is a proper form of construction (iii). However, this sentence is problematic for a number of other reasons.)

111.3 Other misuse

111.3.1 Misused to mean *similar*

The adjectives *same* and *similar* cannot be used interchangeably. Sometimes I find *same* used when the intended meaning is expressed by *similar.* In particular, the following type of misuse is common.

(1) The application of this method is quite the same as that of the method discussed in the previous section.
(1) The application of this method is quite similar to that of the method discussed in the previous section.

Although expressions like "quite the same," which imply that the quality of sameness can exist in degrees, sometimes are used, this usage is somewhat informal. In general, when precise language is necessary, and in particular in mathematical and scientific contexts, the adjective *same* should only be used as a synonym of *identical.*

111.3.2 Missing *the*

In almost all cases, *same* is preceded by the definite article, *the.*[4] Consider the following.

(2) These are same basis vectors.
(2) These are the same basis vectors.
(3) This value is almost same as that found previously.

[4]The very rare usage in which *the* does not appear is of no relevance to scientific writing. For the most part, such usage is reserved for legal and commercial writing. (See usage note under *same* in The American Heritage Dictionary of the English Language [1].) There are, however, situations in which *same* is used in combinations with other words when *the* is not needed (for example, *same-sign terms*, *same-order effects*).

(3) This value is almost the same as that found previously.
(4) We have found that the general form of this function is a same as one of those considered by Webber.
(4) We have found that the general form of this function is the same as that of one of the functions considered by Webber.
(5) There is no difference between these methods in the present case, because here the spectra of Γ and $\tilde{\Gamma}$ are same.
(5) There is no difference between these methods in the present case, because here the spectra of Γ and $\tilde{\Gamma}$ are the same.

The reason that, in general, *same* must be preceded by *the* can be understood by considering the above sentences. This is quite obvious in (2). The use of "same" here necessarily implies that the "basis vectors" have already been specified. (If this were not the case, this use of "same" would clearly be illogical.) Then, because unique specification of that to which a noun refers is the necessary and sufficient condition for it to take the definite article, in the present case, "basis vectors" must be preceded by "the." The situation in the remaining examples is somewhat more complicated, as there the noun in question (i.e., that modified by "same") does not appear. However, note that in these cases, "same" in fact is being used to mean *same value*, *same general form* and *same spectrum*.[5] Then, since those things referred to by the implicitly appearing nouns, *value*, *form* and *spectra*, have indeed been uniquely specified (as "that found previously," "one of those considered by Webber" and "the spectra of Γ and $\tilde{\Gamma}$"), we find that *the* is necessary here for essentially the same reason as in the first example. Finally, note that there is the additional problem in (4) that "same" is being used to compare unlike things.[6]

[5] In this sense, it is natural to think of "same" in these examples as a pronoun. Indeed, some grammarians regard it as such when used in this manner. (See 英文法解説 [8].)

[6] In this sentence, "form" is being compared with "one." However, the latter does not refer to "form" but, rather, to "function."

Chapter 112

saturate and *saturation*

The verb *saturate* and the noun *saturation* are occasionally misused in the manners demonstrated below.

(1) This solution saturates the lower bound
(1) This solution is that for which the lower bound is realized.
(1*) For this solution, the lower bound is realized.
(2) This inequality is saturated when w^α satisfies the following equation:
(2) The equality holds in this relation when w^α satisfies the following equation:
(3) It has been found that domain walls in supersymmetric theories can saturate this upper bound.
(3) It has been found that for domain walls in supersymmetric theories, this upper bound can be realized.
(4) But, when $p = 2$, this dimension already saturates the largest dimension, $4q + 4$, for the hypermultiplet $\mathcal{A}$.
(4) But, when $p = 2$, this dimension already becomes equal to the largest dimension, $4q + 4$, for the hypermultiplet $\mathcal{A}$.
(5) As seen from this figure, the domains initially grow very rapidly, but they are almost saturated by $t \approx 10^3$.
(5) As seen from this figure, the domains initially grow very rapidly, but by $t \approx 10^3$ they /have almost reached their asymptotic size/they have essentially stopped growing/their growth has nearly stopped/.
(6) This function saturates to $A\sin(k_0x + \phi_0)$, with $A \approx 1.33$ and $\phi_0 \approx .041$, rather quickly.
(6) This function converges to $A\sin(k_0x + \phi_0)$, with $A \approx 1.33$ and $\phi_0 \approx .041$, rather quickly.
(7) Therefore, the conditions of saturating the energy bound are satisfied.
(7) Therefore, the conditions for which the energy bound is realized are satisfied.
(8) The $D(q)$ curve seems to saturate to a horizontal line, denoted $D(\infty)$.
(8) The $D(q)$ curve seems to approach a horizontal line, denoted $D(\infty)$.
(9) The number of such white dwarfs increases with time and saturates

at a value reflecting a balance between decay and production.
(9) The number of such white dwarfs increases with time and /converges to/approaches/ a value reflecting a balance between decay and production.
(10) In the case of a black hole, the Schwarzschild bound is saturated.
(10) In the case of a black hole, the Schwarzschild bound is realized.
(11) This case corresponds to saturation of the inequality (4.1).
(11) This case corresponds to that in which the equality is realized in (4.1).
(11*) In this case, equality is realized in (4.1).
(12) Saturation of the upper bound occurs at $t = t_*$.
(12) The upper bound is /realized/reached/ at $t = t_*$.

While *saturate* and *saturation* do possess mathematical meanings,[1] these do not include the meanings that these words are intended to express in the above examples. In particular, it is important to note that we never use *saturated* to describe a bound or inequality. Also, *saturate* can never be used in place of *converge* or *approach* in mathematical contexts.

The above should be compared with the following proper uses.

(13) The air eventually becomes saturated with water vapor.
(14) The core flux oscillates between positively and negatively saturated states.
(15) In this case, the base current does not saturate the transistor.
(16) The energy of induced emission is no longer linearly dependent on the incident radiation energy. Thus the system has reached saturation.
(17) The specimen was then magnetized to saturation.
(18) We assume that the thin layer of liquid on the surface is saturated with each of the soluble materials.
(19) In this way, almost all of the double bonds come to be saturated.
(20) Neutron star matter exists in a state well beyond the saturation density of nuclear matter.

As demonstrated by these examples, in physical systems, usually *saturate* and *saturation* are used to describe a situation in which some component or attribute exists in a state of maximal number, amount, strength, etc., or is characterized by some other type of limiting condition. In such a situation, we say that this component or attribute saturates the system and hence that the system is saturated with or saturated by the component or attribute. In mathematics, these terms can be used in the manners mentioned in the footnote of this chapter. It is clear that the situations considered in (1)–(12) are very different from those exemplified by these proper usages.

[1] For example, in model theory, there are *saturated logical systems*, in the theory of simplicial sets, there are the concepts of a *saturated class of morphisms* and a *saturated closure*, in the theory of excellent rings, there are *saturated sequences of prime ideals*, and in approximation theory, there exist *saturation phenomena*.

Chapter 113

similar

113.1 Introduction

The adjective *similar* is among the handful of words most frequently misused by Japanese authors. Here I treat the types of mistakes that create particularly serious problems.

Before considering examples demonstrating the misuse of this word, I first briefly discuss its proper use. The adjective *similar* is used to compare nouns referring to distinct entities. There are three basic ways in which it can be used, as demonstrated by the following sentences, which are essentially identical in meaning.

(1) Operations A and B are similar.
(2) A and B are similar operations.
(3) The operation A is similar to B.

In all of these sentences, "similar" compares the two nouns "A" and "B," but the grammatical roles of these three differ in each case. In (1) "A and B" forms a compound subject that is modified by "similar." In (2), "A and B" again acts as the subject, but "similar" modifies the noun "operations," which acts as the complement relating to the subject. In (3) "A" is the subject and is modified by "similar," while "B" is the object of the preposition "to." In (1) and (3), "similar" acts as a predicate adjective, and in (2) as an attributive adjective.

Below, I illustrate common misuses of this word.

113.2 Misused with *as*

Here I present examples illustrating one of the most common ways in which *similar* is used incorrectly.

(1) We proceed in a similar way as described in Ref. 1.
(1) We proceed in a manner similar to that described in Ref. 1.
(1*) We follow a procedure similar to that described in Ref. 1.
(2) Here we consider a similar possibility as discussed in the zero-field case.

(2) Here we consider a possibility similar to that discussed in the zero-field case.
(3) x is obtained in a similar manner as that used in Ref. [1].
(3) x is obtained in a manner similar to that of Ref. [1].
(3*) x is obtained with a method similar to that used in Ref. [1].
(4) This configuration has a similar excitation energy as the anti-symmetric one.
(4) This configuration has an excitation energy similar to that of the anti-symmetric configuration.

Simply stated, the problem with the original sentences here is that *similar* cannot be used to form a pair with *as*. The misconception reflected by these sentences seems to result from a misguided analogy to the adjective-preposition pair *same as*. It is important to note that neither the expression *similar as* nor *similar + [noun] + as* is possible.

In (1) and (2), it seems that the authors intended to use "as" in place of something like *to that*, with "to" acting as a preposition[1] and "that" as a pronoun. However, simply changing "as" to *to that* here would result in awkward (albeit meaningful) sentences, because the adjective-preposition pairs *similar to* in them would be split. In general, when the set *similar to* is split in this way, the grammatical role of *similar* in comparing nouns becomes unclear. (Note that the usage of "similar" in the sentences obtained by changing "as" to *to that* in the originals is not represented by any of the three basic patterns illustrated in the previous section.) This problem is solved in the rewritten versions. In (1), "similar" means *which is similar*.[2] In this sentence, the grammatical structure matches the meaning expressed by "similar," as now it is clearly being used to compare two nouns, "manner" and "that." Here "similar" modifies the former.[3]

The problems in (3) and (4) are essentially the same as those in (1) and (2), but in these sentences, "as" is apparently being used to mean something like *to* rather than *to that*.

The most important points of the discussion given here are summarized by the following two rules. First, *similar* can be used in an adjective-preposition pair only with *to*, and, second, this pair should not be split. In the next section I present a number examples that violate the second rule.

[1] Note that the adjective-preposition pair *similar to* does exist.

[2] The use demonstrated here of a participle relative clause ("similar to that described in Ref. 1") in place of a longer finite relative clause (*which is similar to that described in Ref. 1*) is quite common.

[3] Grammatically, we have the following structure: *[subject* ("We")*] + [main verb* ("proceed")*] + [prepositional phrase* ("in a manner")*] + [relative clause* ("similar to that described in Ref. 1")*]*. The relative clause here modifies the object of the prepositional phrase, "manner." (Note that there is also a prepositional phrase inside the relative clause, "to that described in Ref. 1." The object of this prepositional phrase is "that.")

113.3 The problematic construction *similar + [noun] + to*

As mentioned above, *similar* can form an adjective-preposition pair with *to*. However, I often find this set misused in the split form *similar + [noun] + to*. The following illustrate this problem.

(1) This is easily shown by the similar method to Eqs. (3.3)–(3.5).
(1) This is easily shown using a method similar to that applied to Eqs. (3.3)–(3.5).
(2) In a similar way to the calculation for (3.1), we obtain the following.
(2) Employing a calculation similar to that /used in deriving/which produced/
yielding/ (3.1), we obtain the following.
(3) By the similar manner to the proof of Theorem 3, we can show that these curves never cross.
(3) We can show that these curves never cross using a method similar to that employed in the proof of Theorem 3.
(3^*) Using arguments similar to those in the proof of Theorem 3, we can show that these curves never cross.
(3^{**}) Using a /method/manner/ of proof similar to that applied to Theorem 3, we can show that these curves never cross.
(4) This has previously been treated with a similar method to that used above.
(4) This has previously been treated with a method similar to that used above.
(5) We can construct a similar theory to that in Ref. 1 if we simply consider ρ as a slowly varying function of time.
(5) We can construct a theory similar to that in Ref. 1 if we simply regard ρ as a slowly varying function of time.
(6) By a very similar argument to that given above, we can show that σ vanishes.
(6) By an argument very similar to that given above, we can show that σ vanishes.
(7) This analysis yields a very similar fit to the data as that obtained with $\sigma = 0$.
(7) This analysis yields a fit to the data very similar to that obtained with $\sigma = 0$.
(8) This weakly coupled oscillatory reaction-diffusion system has a similar property to the plasmodium.
(8) There is a property of this weakly coupled oscillatory reaction-diffusion system that is similar to a property of the plasmodium.
(8^*) This weakly coupled oscillatory reaction-diffusion system is similar to the plasmodium with regard to a certain property.
(8^{**}) This weakly coupled oscillatory reaction-diffusion system is similar to the plasmodium in a certain respect.

In general, the expression *similar to* should be regarded as a set phrase that cannot be split. The cause of the misuse illustrated here seems to be the misconception that because *similar* is an adjective it must appear before the noun it modifies. (For discussion of the same problem involving other adjective-preposition pairs, see Chapters 37, 47 and 92.)

I now briefly discuss some additional points pertaining to the above examples. The use of "by" in (1) is poor.[4] Also, as discussed in Section 7, the use of *the* with a noun modified by *similar* is, in general, mistaken. The implication of its use in this sentence is that there can be only one method similar to that applied to "Eqs. (3.3)–(3.5)." Finally, this sentence compares unlike things ("method" and "Eqs. (3.3)–(3.5)"), and in this sense is illogical. There is a similar problem in (2) with regard to the use of "way." Note here that the phrase "similar way to the calculation" implies that this "way" is a calculation. It seems that the author wished to assert that the "way" of this calculation is similar to the "way" of the calculation for (3.1), but the sentence does not express this meaning. The problems in (3) are similar to those in both (1) and (2). Particularly problematic here is the illogical implication of the phrase "similar manner to the proof" that this "manner" itself constitutes a proof. In (7), it is not clear if "similar" is being used together with "to" or "as." As in (1), (2) and (3), in (8) unlike things are compared.

113.4 Misused with other prepositions

As mentioned above, *similar* can form a pair only with the preposition *to*.[5] The preposition most commonly used erroneously in this role is *as*, considered in Section 2. The following are representative of the misuse of other prepositions.

> (1) As is similar with most models describing fingering phenomena, there is some ambiguity in the velocity of propagation.
> (1) As is the case with most models describing fingering phenomena, there is some ambiguity in the velocity of propagation.
> (2) This behavior is similar between the two cases.
> (2) This behavior is similar for the two cases.

In the first example, "similar" does not express the intended meaning. In (2) note that, although "for" happens to appear directly after "similar," they do not form an adjective-preposition pair. This can be seen from the fact that this sentence could be rewritten as *For the two cases, this behavior is similar.*

113.5 Modification problem

The sentences below illustrate a frequently encountered misuse in which *similar* does not modify anything.

[4] For further explanation of this point, see Chapter 29.

[5] Formerly, *with* was also used in this role, but according to the Oxford English Dictionary [4], in current English this is not accepted.

(1) Similar to Ref. [2], we ignore the smallest of these terms.
(1) As in Ref. [2], we ignore the smallest of these terms.
(2) Similar to the classical case, we first derive the commutator $[S, T^{\dagger}]$.
(2) In analogy to the classical case, we first derive the commutator $[S, T^{\dagger}]$.
(2*) As in the classical case, we first derive the commutator $[S, T^{\dagger}]$.

As stated above, the role of the adjective *similar* is to compare nouns, and there are three basic grammatical forms in which it can be used to do this. Clearly, neither of the originals above employs "similar" in any of these ways. In each case, it seems that the author intended to use "similar to" as an adverb, modifying the main verb with a meaning something like that of "as in." This is simply a grammatical mistake. If we were to force a grammatically correct interpretation on the above sentences, in (1), "similar" would have to be understood as modifying the subject, "we," and the result would be a comparison between the nouns "we" and "Ref. [2]," while in (2), the comparison would be between "we" and "the classical case." Obviously, these comparisons are illogical.

113.6 Comparison of unlike things

In this section I consider a problem discussed briefly with regard to (1)–(3) and (8) of Section 3 and (1) and (2) of Section 5.

Logically, it is necessary that the things compared by *similar* be of the same type. The following typify mistaken usage in which it is used to compare things of different types.

(1) This result is similar to the non-conserved case.
(1) This result is similar to that in the non-conserved case.
(2) The fact that this sudden decrease of long-range order follows a local ordering is similar to some of the systems mentioned above.
(2) This behavior, in which a sudden decrease of long-range order follows a local ordering, is similar to that exhibited by some of the systems mentioned above.
(3) All DV-type events were investigated with similar selection criteria to the $f_0/a_0/\phi$ production event.
(3) All DV-type events were investigated with selection criteria similar to those used for the $f_0/a_0/\phi$ production event.
(4) In a similar analysis to the previous model, we can derive dynamical equations.
(4) Using analysis similar to that applied to the previous model, we can derive dynamical equations.
(5) In a similar way to the derivation of Eq. (5.1), we obtain the following:
(5) With a derivation similar to that yielding Eq. (5.1), we obtain the following:

The comparisons made in the original sentences are between the following: (1) "result" and "case"; (2) "fact" and "systems"; (3) "criteria" and "event"; (4) "analysis" and "model"; (5) "way" and "derivation."

113.7 Misused with *the*

As mentioned in Section 3, it is usually inappropriate to use the definite article *the* with a noun modified by *similar*. The following illustrate typical misuses.

> (1) In general, we can proceed the similar calculation up to nth order.
> (1) In general, we can proceed with a similar calculation up to nth order.
> (2) The similar behavior is observed when the concentration of polymer lipids is gradually increased.
> (2) Similar behavior is observed when the concentration of polymer lipids is gradually increased.
> (3) The similar defect structure to that observed by experiments is found under suitable conditions.
> (3) Defect structure similar to that observed experimentally is found under suitable conditions.
> (4) These two pairs of operators may satisfy the similar commutation relation.
> (4) These two pairs of operators may satisfy similar commutation relations.

The original sentences here are very strange, because they imply that there is only one possible "calculation," "behavior," "defect structure" and "commutation relation" that is similar to some other under consideration, whereas, in fact, there are obviously many (possibly infinitely many) of each. In addition, note the following. In (1), there is a problem with the verb "proceed." This is an intransitive verb,[6] but it is being used here as a transitive verb (with the direct object "calculation"). In (3), we have the structure *similar + [noun] + to* (see Section 3). In addition, its use of "by" is problematic.[7] In (4), use of the singular "relation" is inappropriate, because there are two commutation relations, one corresponding to each pair of operators.

[6] An intransitive verb does not take a direct object.

[7] See Chapter 29 for discussion of similar misuses of *by*.

Chapter 114

similarly

In this chapter, I discuss the most frequently encountered problems involving the adverb *similarly*.

114.1 The expression *similarly to*

114.1.1 Correct use

The expression *similarly to* is often misused. Its correct use can be understood from the following.

> (1) The coefficients c_i transform similarly to the couplings γ_i.

As demonstrated by this sentence, *similarly to* is used to make a comparison with respect to some action. This action is expressed by the verb modified by *similarly*, and the things being compared are represented by the subject of this verb and the object of the preposition *to*. In the above sentence, this verb is "transform," and these nouns are "c_i" and "γ_i." The most important point to keep in mind regarding the use of this expression is that, as with *similar*,[1] the two nouns involved in the comparison it carries out must represent things of the same type. In the following, I consider typical examples in which this rule is violated.

114.1.2 Incorrect use

> (2) Similarly to the case considered in the previous section, we make use of the smoothness of these functions in obtaining a result here.
> (2) As in the case considered in the previous section, we make use of the smoothness of these functions in obtaining a result here.
> (2*) With a method similar to that demonstrated in the previous section, we make use of the smoothness of these functions in obtaining a result here.
> (3) The coefficient for the asymmetric case is also calculated similarly to the symmetric case.

[1] See the previous chapter.

(3) The calculation of the coefficient in the asymmetric case is similar to that in the symmetric case.
(3*) The coefficient for the asymmetric case is calculated similarly to that for the symmetric case.
(3**) The coefficients for the asymmetric and symmetric cases are calculated similarly.
(4) In this figure we see the peaks gradually approaching each other, similarly to Fig. 1.
(4) In this figure we see the peaks gradually approaching each other, as in Fig. 1.
(4*) In this figure the peaks gradually approach each other in a manner similar to that depicted in Fig. 1.
(4**) This figure shows that the peaks approach each other in a manner similar to that in the previous case, depicted in Fig. 1.
(5) Similarly to the BCS theory, minimizing F, we obtain the following:
(5) In analogy to the BCS theory, minimizing F, we obtain the following:
(5*) As in the BCS theory, minimizing F, we obtain the following:

The verb modified by "similarly" and the nouns involved in the comparison in the above original sentences are the following: in (2) the verb is "make use," and the nouns are "we" and "case"; in (3) the verb is "calculated," and the nouns are "coefficient" and "case"; in (4) the verb is (apparently) "approaching," and the nouns are "peaks" and "Fig. 1"; in (5) the verb is "obtain," and the nouns are "we" and "theory." It is thus seen that in each case, "similarly to" is used erroneously to compare the behavior of two different types of things.

The difference between (2) and (2*) is that the former implies only that the smoothness is used in both cases, while the latter implies that the methods with which it is used are similar. The difference between (4) and (4*) is similar.

114.2 Misused with other prepositions

Like the adjective *similar*, the adverb *similarly* forms a pair only with the preposition *to*. Sometimes I find it used with other prepositions in this way. The following are typical.

(1) This form factor behaves similarly as that studied by Wilson and James.
(1) This form factor behaves similarly to that studied by Wilson and James.
(2) Similarly as the larger system, there are two points below the x axis in the present system.
(2) There are two points below the x axis in the present system, as in the larger system.
(3) Similarly with the first example, we find exponential decay asymptotically here.
(3) As in the first example, we find exponential decay asymptotically

here.
(4) Similarly in the classical case, the solution in the quantum case is undefined at the origin.
(4) As in the classical case, the solution in the quantum case is undefined at the origin.

Chapter 115

since

115.1 Introduction

In formal written work, care must be taken when using *since* as a synonym of *because*. Although in some cases these words can be used interchangeably, there are many situations in which such use of *since* can result in ambiguous or unnatural assertions. There are three reasons for this. First, while *since* possesses several meanings, its primary meaning is of a purely time-like nature (... 以来, ... してから, ... の時からずっと, ... した時から, etc.), and therefore, unless it is clear that this is not the intention, it will be interpreted with such a meaning. Second, even when it is evident that *since* is being used as a synonym of *because*, it imparts a time-like nuance.[1] Hence, for example, it is natural in a situation like that below.

> (1) Since you've already answered my question, I won't trouble you further.

Here, although the meaning of "since" is close to that of *because*, there is clearly a time-like connotation. When such a connotation is not appropriate, use of *since* can be quite unnatural. Third, the connection expressed by *since* is much less direct than that expressed by *because*. For this reason, when the intention is to indicate a direct logical or causal connection, *since* should not be used.

115.2 Ambiguous use

Consider the following.

> (1) Since this theory was constructed employing the basic assumption stated above, the question of its applicability in the present case requires thorough investigation.
> (1) Because this theory was constructed employing the basic assumption stated above, the question of its applicability in the present case requires thorough investigation.

[1] For example, see the usage note in The American Heritage Dictionary of the English Language [1].

(2) This result cannot be trusted, since we did not properly treat the non-linear terms.
(2) This result cannot be trusted, because we did not properly treat the non-linear terms.
(3) We find that this conclusion is the most reasonable since Winston proved the non-existence of f_0 in the present case.
(3) We find that this conclusion is the most reasonable, noting that Winston proved the non-existence of f_0 in the present case.

In each of the original sentences here, "since" could be interpreted with a purely time-like meaning, but the intended meaning is different. Although with sufficient thought, the reader would be able to conclude that in fact "since" is not meant to express a purely time-like meaning, such unnecessarily confusing word choice is the epitome of poor style.

The first clause in (1) could be construed as meaning *Since the time that this theory was constructed...* Reading the second clause, however, it is seen that this is not the meaning that the author sought to express. Similarly, (2) could be understood as meaning that the result in question has been dubious since the time that the non-linear terms were not treated properly. The intended meaning, however, is that expressed by (2). Of the examples here, (3) is probably most problematic. This allows the interpretation that "this conclusion" became the most reasonable after Winston gave the stated proof. The intended (and much more natural) meaning is that clearly expressed by (3). In this case, "noting that" is more suitable than *because*. If we used *because* here, the implication would be that the reasonableness of this conclusion is a result of Winston proving the non-existence of f_0. This represents too direct a connection between this particular proof and the reasonableness of the conclusion. In fact, the direct connection here is between the non-existence of f_0 itself and the reasonableness of the conclusion. Thus, in addition to (3), the following is possible: *We find that this conclusion is the most reasonable, because f_0 does not exist in the present case, as proved by Winston.* This correctly expresses the meaning that this reasonableness follows directly from the fact that f_0 does not exist.

It is important to note that, to a large extent, the ambiguity in the original sentences here results from the use of past tense verb forms ("was" in (1), "did...treat" in (2) and "proved" in (3)) in the clauses introduced by "since." This should be compared with the situation in the examples given in Section 4.

115.3 Unnatural use

In each of the following sentences, because the actual logical or causal connection under consideration is quite direct, use of "since" is unnatural.

(1) In the present case, the latter method is superior, since it accounts for a wider range of energies.
(2) Since additional selection criteria are imposed on the reconstruction of the specific reactions, it is possible to obtain an event sample that is

almost free of uncertainties arising from the categorization with respect to event topology.
(3) Since we selected the Λ that decayed into p and π^-, events of the kind considered in the previous section were excluded.
(4) Since the system is invariant under uniform phase transformations, there is no force acting to change $\varphi(t)$.
(5) Since $h_i^\nu(t)$ is independent of ξ_i^ν, we can easily average the square of the first term.
(6) Then, since the embedding $Q^2(\Sigma) \hookrightarrow Q_0^1(\Sigma)$ is compact, R is a compact operator on $Q_0^1(\Sigma)$.
(7) Since g is a uniformly bounded and linear operator on the set W, we can construct A as follows:
(8) Since $[I - F_\lambda]_{h0}^{-1}$ exists, G is invertible.

In each case here, "since" should be changed to *because*. Generally, in sentences of the form *since A, B* or *B, since A*, the meaning imparted by "since" is that, while B can be regarded as resulting causally or following logically from A, the relation between the two is neither direct nor inevitable. In all of the above examples, however, the stated result or implication seems to follow as a natural and unavoidable consequence. Thus "since" is inappropriate. Note, by contrast, that in (1) of Section 1, "I won't trouble you further" does *not* follow as a natural, inevitable consequence of "you've already answered my question." The situation is similar in the example sentences given in the next section.

115.4 Proper use

In this section, I present examples demonstrating proper use of *since* as a synonym of *because*.

(1) Since detailed discussion of the experiment is given in Ref. [4], we only summarize the results here.
(2) Since this quantity can take several values, we treat it as an unknown in the following analysis.
(3) The distinction between L and $\mathcal{L}$ is usually ignored, since it has been shown that in almost all cases of interest, they are identical.

In these sentences, the intention is not to express a direct logical or causal connection, and for this reason, the meaning conveyed by "since" is appropriate. Also, unlike the examples in Section 2, in (1) and (2) the clause introduced by "since" contains a present tense verb ("is given" and "can take"), and for this reason, there is no danger of ambiguity. Now, note that in (3), the verb in the dependent clause ("has been shown") is in present perfect form. This, in fact, introduces a certain degree of ambiguity. However, this ambiguity is not problematic, as the meaning of the sentence as a whole is essentially independent of whether "since" is interpreted as meaning *because* or *since the time that*.

Chapter 116

so

There are several ways in which *so* is misused. Here I examine the most common of these.

116.1 *so that* misused as a synonym of *such that*

Sometimes the expression *so that* is misused in place of *such that*.[1] Consider the typical example below.

> (1) The partition $\lambda = (\lambda_1, \lambda_2, \cdots, \lambda_N)$ forms a non-decreasing series of positive integers so that $\sum_{i=1}^{N} \lambda_i \leq N/2$.
> (1) The partition $\lambda = (\lambda_1, \lambda_2, \cdots, \lambda_N)$ forms a non-decreasing series of positive integers /such that/that satisfies/ $\sum_{i=1}^{N} \lambda_i \leq N/2$.

Here, the intention is to describe the situation in which the relations $\sum_{i=1}^{N} \lambda_i \leq N/2$ place restrictions on the series in question. The meaning of the original, by contrast, is that these relations follow from the fact that this is a non-decreasing series of positive integers. This is clearly not true.

116.2 *so that* misused as a synonym of *for which*

The following illustrates a common misuse of *so that* to mean *for which*.

> (1) Through this analysis, we were able to determine the region in parameter space so that the condition $\tau < \Sigma$ is satisfied.
> (1) Through this analysis, we were able to determine the region in parameter space for which the condition $\tau < \Sigma$ is satisfied.

The phrase *so that* cannot be used as a synonym of *for which*. The correct use of *so that* is discussed in Section 4 of Chapter 119.

[1] For a comparison of their meanings, see Chapter 119.

116.3 *so that* misused as a synonym of *therefore*

The following example demonstrates a somewhat subtle point regarding the meaning of *so that*.

> (1) We are presently treating the case in which $\gamma_1/\gamma_2 \ll 1$, so that we ignore the last term in (5.3).
> (1) We are presently treating the case in which $\gamma_1/\gamma_2 \ll 1$, and /for this reason/therefore/ we ignore the last term in (5.3).
> (1*) We are presently treating the case in which $\gamma_1/\gamma_2 \ll 1$, so that we can ignore the last term in (5.3).
> (2) These expressions are cumbersome, so that approximate forms are also given.
> (2) These expressions are cumbersome, and for this reason, approximate forms are also given.

Although *so that* can be used as a synonym of *and therefore*, it actually expresses a meaning closer to *and therefore, as a necessary consequence*. For this reason, it is inappropriate in (1), because it seems to imply that what "we" do (that is, "ignore the last term in (5.3)") is determined as a necessary consequence of the fact that the relation $\gamma_1/\gamma_2 \ll 1$ holds. Note, however, that it is appropriate in (1*), because here, that which is stated as following as a necessary consequence of this relation is not that "we ignore..." but that "we can ignore..." The problem in (2) is similar.

116.4 *so as to* misused as a synonym of *to*

There is a slight difference in meaning between *so as to* and *to*, as used in the example below.

> (1) Extremely long polymers are used so as to modify the rheological properties of the material.
> (1) Extremely long polymers are used to modify the rheological properties of the material.

The first sentence suggests that these polymers are used in a particular manner chosen specifically to modify the rheological properties. Its connotation is that, while there are manners of using long polymers for which the rheological properties are not changed, for the particular manner used here, they are changed. The assertion of the second sentence is much more neutral, and there is no implication regarding the manner in which the polymers are used. The actual meaning intended by the author is that expressed by (1). This can easily be guessed, as it would seem that using extremely long polymers in *any* way would change the rheological properties of a material to some extent. By contrast, in the following sentence "so as to" is more natural than *to*.

> (2) Extremely long polymers are used so as to modify the rheological properties of the material to such a degree that the non-Newtonian properties can no longer be ignored.

In this case, because there are obviously ways of using such polymers that would not yield the stated result (for example, using very few of them), the implication regarding *manner* that is expressed by "so as to" is appropriate. Then, because *to* lacks such an implication, its use would be somewhat unnatural here.

116.5 *so* misused as a synonym of *therefore*

The sentence below demonstrates a common problem.

> (1) In this case the ground state energy is degenerate. So here we must use the more general approach.
> (1) In this case the ground state energy is degenerate. /Thus/Therefore/Hence/Consequently/For this reason/ here we must use the more general approach.
> (1*) In this case the ground state energy is degenerate, so here we must use the more general approach.

In the original here, "so" acts as an adverb and is being used as a synonym of *therefore*. Although *so* can be used in this way, there are two problems with the above. First, when used as an adverb, *so* generally expresses a much weaker causal or logical relationship than do such expressions as *thus*, *therefore*, *hence*, *consequently*, *for this reason* and *as a result*. For this reason, because in the example above the relation between the degeneracy and the necessity of using the general method is quite direct, this use of "so" is unnatural. Indeed, the indirect and often vague connection expressed by *so* is inappropriate in many typical types of arguments made in scientific and mathematical contexts. The second problem with the above use of "so" is that, when used with the meaning considered presently, its appearance at the beginning of a sentence is somewhat unnatural. In general, it is better used to introduce a clause, preceded by *and*.

116.6 *so* misused in place of *for* to express purpose

The following demonstrate a commonly held misconception regarding the meaning of *so*.

> (1) These stipulations are necessary so the numerically obtained value can converge.
> (1) These stipulations are necessary for the numerical value to converge.
> (1*) We impose these stipulations so that the numerical value converges.
> (2) So localization can occur, the two terms in (4.4) must be small.
> (2) For localization to occur, the two terms in (4.4) must be small.
> (2*) So that localization can occur, we make the two terms in (4.4) small.
> (3) The system must be very dilute so these terms are negligible.
> (3) The system must be very dilute for these terms to be negligible.
> (3*) We must make the system very dilute for these terms to be negligible.
> (3**) These terms can be ignored only if the system is very dilute.

The first problem with the original sentences above is that they are ambiguous. There are two possible interpretations of each sentence, corresponding to two possible interpretations of "so." The first is that the "so..." clause states a result of that described in the other clause, and the second is that the "so..." clause states the purpose of that described in the other clause.[2] The second problem is that with either interpretation, these sentences are logically problematic, as I now discuss.

With the first interpretation, the meaning of (1) is the following: *These stipulations are necessary, and as a result the numerically obtained value can converge.* This is somewhat illogical[3] and clearly not the intended meaning. The second interpretation gives the meaning intended by the author. The problem here, however, is that when *so* is used in this way, the clause in which *so* does not appear must express an *action* whose purpose is stated in the clause in which *so* does appear. The very common misconception reflected by (1) is that the former clause should express a *condition*. The simplest way to remedy this problem is to rewrite the sentence as follows: *We impose these stipulations so that the numerically obtained value can converge.* However, while there is no problem with this rewritten form from the linguistic point of view, its meaning is somewhat strange conceptually. In order to understand this, there are two points to consider. First, it is more natural to think that the reason we impose these stipulations is so that the numerical value *will* converge, not so that it *can* converge. Second, this rewritten version expresses the same mathematical misrepresentation as the original. Note that (1) makes an assertion with regard to the "numerically obtained value." The import is that if these stipulations are not made, this value diverges. Thus this sentence leads us to believe that there are two cases, that in which the "numerically obtained value" converges and that in which it diverges. However, this is problematic, because in the latter case, in fact a numerical value would not be "obtained" (i.e., the numerical calculation would simply fail to provide a meaningful result). Changing the above sentence by taking these two points into account, we have (1*). However, although there is no particular problem with this sentence itself, (1) seems to more accurately express the meaning intended by the author.

The discussion given above applies to (2) and (3) as well. It should be noted that there are slight differences in meaning between (2) and (2*) and among (3), (3*) and (3**).

Before ending this section, I give some discussion regarding the use of *for* demonstrated by the examples above. In (1), (2), (3) and (3*) "for" is used to express purpose. In general, this is done with the following type of construction: *[main clause (expressing a necessary condition or the necessity of an action)] + for + [noun or noun clause].* In (1), (2) and (3), the main clause expresses a condition, and in (3*) it expresses an action. Grammatically, *for* used in this manner is a preposition, and the noun following it is its object. This noun expresses the purpose of the action or condition described in the main clause. In each of the above examples, the object

[2] We should note that, generally, *so that* is preferable to *so* for the purpose of expressing this second meaning. (See, for example, discussion of usage under *so* in The American Heritage Dictionary of the English Language [1].)

[3] Here the assertion is that the convergence follows from the necessity of the stipulations, when in fact, it follows from the stipulations themselves.

of "for" is in fact a noun clause: "the numerical value to converge," "localization to occur" and "these terms to be negligible." This is the most common situation, but sometimes this object is just a simple noun, as in the following: *For integrability, we must impose an additional condition.*

116.7 *so* misused as a synonym of *very*

Although the adverb *so* is sometimes used as a synonym of *very*, this usage is quite informal and imprecise, and it should be strictly avoided in scholarly writing. The following demonstrate this misuse.

> (1) In this case, S does not change so much.
> (1) In this case, S does not change significantly.
> (1*) In this case, S does not change so much that the results are affected.
> (2) However, the quadrupole interaction is not so strong.
> (2) However, the quadrupole interaction is not as strong as the spin-orbit interaction.
> (2*) However, the quadrupole interaction is not strong enough to allow for observation.
> (2**) However, in this case the quadrupole interaction is not so large that the more sophisticated calculational method is needed.
> (3) This result is not different from the previous one so much.
> (3) This result does not differ /greatly/significantly/ from the previous one.
> (4) However, this effect is not so small.
> (4) However, this effect is not negligibly small.
> (5) This point is not so important.
> (5) This point is not particularly /significant/important/.
> (6) This convergence, however, is so slow, and we were therefore forced to truncate the numerical computation before the true asymptotic form was realized.
> (6) This convergence, however, is very slow, and we were therefore forced to truncate the numerical computation before the true asymptotic form was realized.
> (6*) This convergence, however, is so slow that even after several months of computing time, we were not able to identify any kind of limiting behavior, and we were therefore forced to truncate the numerical computation before the true asymptotic form was realized.

The problem demonstrated by the above original sentences is the following. Here, "so" is used to express the idea of large or small size, extent, strength, etc. However, without identifying the standard of comparison, such statements are almost meaningless. The use of "significantly" in (1) and (3), by contrast, does not have this problem. For example, implicit in (1) is the idea that the amount by which S changes is not so large that the conclusion of the present investigation will be affected. The uses of "so" in (1*), (2**) and (6*) are acceptable because there the

standard of comparison is explicitly expressed. (Note that in these sentences, "so" is not synonymous with *very*.) The rewritten versions of (2) represent certain feasible situations that the author may have had in mind.

116.8 *so* misused as a synonym of *as* in comparisons

So can be used in comparisons in the manner illustrated below.

(1) This effect is not so small as that seen above.

The important point to note here is that this is a negative assertion. Compare this with the following.

(2) This term is at least so large as α_0.
(2) This term is at least as large as α_0.

As demonstrated here, *so* cannot be used in expressions of comparison made within affirmative assertions.[4] In such situations, *as* is the correct choice. Although expressions of the form *so + [adjective] + as* do exist (in particular, *so much as*, *so far as* and *so long as*), these are idiomatic, and they are not used to express comparison.

[4]According to the Oxford English Dictionary [4], this use of *so* is "archaic or dialectal."

Chapter 117

so far

Use of the expression *so far* to mean *up to the present* should be avoided in written work.[1] There are three reasons for this. First, this expression has several other meanings, and therefore ambiguity can arise. Second, even when it is clear that the intended meaning is *up to the present*, it is often unclear if this is in reference to the present time or to the present point in the paper. Third, this expression is quite informal.

There are two main ways in which *so far* is misused. These are treated separately in the following sections.

117.1 Superfluous use

In many cases that *so far* is misused, it in fact adds no information, and in such cases it can simply be deleted. The examples below are representative.

(1) Despite several attempts so far to resolve this problem, there is yet no consensus.
(1) Despite several attempts to resolve this problem, there is yet no consensus.
(2) Several methods have been proposed so far.
(2) Several methods have been proposed.
(3) A few theoretical studies have been made so far on such systems.
(3) A few theoretical studies have been made on such systems.
(4) This behavior is not understood so far.
(4) This behavior is not understood.

In each of these cases, it is clear that the discussion applies to events occurring *to the present time*. In (1), (2) and (3), "so far" is not necessary to specify that the "attempts," "proposals" and "studies" referred to have been made in the past. Example (4) illustrates a particularly common type of mistake. Note that if it is stated that something is not understood in an absolute sense (that is, that such

[1] It seems that *so far* (along with *up to now*, *until now* and *to now*, discussed in Chapter 127) is widely used as a matter of habit by Japanese authors as a translation of これまで. This is a poor habit.

knowledge does not presently exist in this world), then it is usually implied that this statement also applies to all past times. Therefore, here too, “so far” is superfluous.

117.2 Misused to mean *to this time*, *to this point*, *yet* or *previously*

The following demonstrate situations in which *so far* is best replaced by one of several other expressions.

(1) Such a transition has not been seen so far.
(1) Such a transition has not been seen to this time.
(2) No real progress has been made so far.
(2) No real progress has yet been made.
(3) In the examples considered so far, we have not properly treated the diffusion term.
(3) In the examples considered to this point, we have not properly treated the diffusion term.
(4) This has been claimed so far.
(4) This has been previously claimed.
(4*) This has been believed to this time.

Among these, (4) is particularly poor. Note that *so far* expresses a continuous meaning in the sense that it applies simultaneously to all times from some past time to the present time. Therefore, (4) expresses the very unusual meaning that the claim in question has been made continuously up to the present.

Chapter 118

such as

The expression *such as* is among those most often misused by Japanese authors. In fact, in the papers I proofread, the incorrect use of this preposition is at least as common as its correct use.

118.1 Correct usage

In general, the word *such* plays the role of specifying a kind or type. The expression *such as* has several meanings, but in all cases, it plays a similar role. Here I give examples demonstrating its correct use.

118.1.1 Used to present examples

In its most common use, *such as* presents examples. It does this in two ways. In one way, it is close in meaning to *for example*, and in the other, it is close in meaning to *of the same kind*. Below I give examples demonstrating these uses.

Used as a synonym of *for example*

> (1) Certain operations, such as the exchange or removal of elements, however, are prohibited.

In this sentence, "such as" could be replaced by *for example* without changing the meaning significantly. It should be noted, however, that there is a somewhat important difference in nuance between these two expressions: *such as* imparts the connotation that those things offered as examples are considered such because they are representative of a certain class, whereas *for example* imparts no such special meaning. Therefore, while the implied meaning of the above is that these "operations" are regarded as examples because they are of a certain type,[1] this implication would be lost if "such as" was changed to *for example*.

[1]In general, *such as* is closer in meaning to のような than to 例えば.

As a synonym of *of the same kind as*

> (2) The function $\sigma(p)$ is discontinuous at infinitely many points. A function such as this is difficult to treat using our method.

Here, "such as this" means *of this kind* or *with this property*. It is important to note that when used in this way, *such as* does not simply mean *similar to* or *like*. In general, its use makes reference to some particular property or characterizing behavior, and the implication is that the thing in question is of the **type** defined by this property and for this reason is an example of this **type**. In (2), it is implicitly expressed that the function $\sigma(p)$ is representative of a particular class of functions – those with infinitely many discontinuities – and the phrase "a function such as this" can be interpreted as meaning *a function belonging to this class*.

It is worthwhile noting the grammatical structure involving "such as" in (1) and (2). In each case, this preposition is contained within a construction of the form *[noun 1] + such as + [noun 2]*. Here, the prepositional phrase *such as + [noun 2]* plays the role of an adjective, modifying *[noun 1]*, and with respect to the rest of the sentence, the construction *[noun 1] + such as + [noun 2]* acts as a grammatical unit. In such a construction, *such as* always plays the role of presenting examples. Below, I consider the use of *such as* in different types of grammatical constructions.

118.1.2 As a synonym of *that which*, *whatever*, *what*

The following illustrate several closely related uses of *such as* that differ from those illustrated above.

> (3) This general problem, such as it might be in any particular case, cannot be solved with this method.
> (4) The quantum world being such as it is, we cannot trust our intuition.
> (5) The real question – such as we must address to make real progress – is how to account for the intrinsic directionality.
> (6) This result is such as we expected.

Note that in none of these examples does "such as" appear in a construction of the form *[noun 1] + such as + [noun 2]* acting grammatically as a unit.[2] In these sentences, "such as" could be replaced by the following with little change of meaning: in (3), *whatever* or *however*; in (4), *what* or *that which*; in (5), *that which* or *what*; in (6), *what* or *that which*. However, the meaning expressed by "such as" is actually closer to the following: in (3), *of whatever nature*; in (4), *the kind of world that*; in (5), *the kind of question that*; in (6), *of the type that*. Thus in these examples, as in (1) and (2), "such as" makes reference to a kind or type.

[2]In (3) and (5), although the words on either side of "such as" are both nouns, these words together do not form grammatical units.

118.2 Incorrect use

118.2.1 Misused to mean *in the same manner as*

I often find *such as* misused in place of the preposition *as* or *like* to mean *similarly to*, *the same as*, or *in the same manner as*. The following are typical.

> (1) The quantity σ represents the degree of order, such as the magnetization in ferromagnetic systems.
> (1) The quantity σ represents the degree of order, like the magnetization in ferromagnetic systems.
> (2) The function $f(\theta)$ converges to a fixed value, such as in the previous example.
> (2′) The function $f(\theta)$ converges to a fixed value, such as the previous example.
> (2) The function $f(\theta)$ converges to a fixed value, as in the previous example.
> (3) In the more general case, v, such as l, becomes a slowly varying function of x and t.
> (3) In the more general case, v, like l, becomes a slowly varying function of x and t.

The original sentences here simply do not make sense.

118.2.2 Misused to mean *similar to*

In the case that an expression of the form *[noun 1] + such as + [noun 2]* acts as a single grammatical unit (for example, as in (1) and (2) of Section 1), the implication is that *[noun 2]* is an example of *[noun 1]* and that it is representative of an entire class of examples. Thus, when used in this manner, *such as* is not a synonym of *similar to*. Rather, it is usually roughly equivalent in meaning to something like *of this type* or, more precisely, *whose /type/class/ is exemplified by*. Sometimes *such as* is misused in place of expressions such as *like*, *similar to* and *analogous to* in the grammatical construction *[noun 1] + such as + [noun 2]*. The examples below are typical.

> (4) To understand the behavior of the system in this regime, a quantity such as the coarse-grained carrier density in a semi-conducting material would be useful.
> (4) To understand the behavior of the system in this regime, a quantity /like/analogous to/similar to/ the coarse-grained carrier density in a semi-conducting material would be useful.
> (5) In our formulation, the behavior can be described by functional dynamics such as those outlined above.
> (5) In our formulation, the behavior can be described by functional dynamics /like/akin to/similar to/of the same type as/ those outlined above.

(6) These molecules have properties such as those of the molecules investigated by Gates et al.
(6) These molecules have properties /like/similar to/resembling/ those of the molecules investigated by Gates et al.
(7) Therefore, in order to solve Eq. (4.4), some method such as SLR might be needed.
(7) Therefore, in order to solve Eq. (4.4), some method similar to SLR might be needed.
(8) As proved below, the vacuum configuration is stable because it has a coordinate dependence such as (6.1).
(8) As proved below, the vacuum configuration is stable because it has a coordinate dependence /like/analogous to/given by/of the form/expressed by/ (6.1).

In all of these examples, "such as" has been incorrectly used as a synonym of *similar to*. In each case, the meaning expressed by "such as" of presenting a representative example is inappropriate. For example, (4) asserts that one quantity that would be useful to understand the behavior under investigation is the coarse-grained carrier density in a semi-conducting material. The intended meaning, however, is not that this carrier density itself would be useful, but that something analogous to it (appropriate for the present application) would be useful. Each of the above original sentences has a similar problem: While the intention is to express a similarity or an analogy, "such as" is interpreted as introducing an example.

As made explicit in (8), possible interpretations of "such as" in the original include the meanings of "given by," "of the form" and "expressed by," in addition to "like" and "analogous to." Interpreted with one of these meanings, (8) is understood as implying that "(6.1)" is an expression describing the "coordinate dependence."

118.2.3 Misused to mean *in the following way* or *of the form*

I sometimes find *such as* used to introduce an expression describing the form of some quantity or the manner in which a quantity behaves. This should be strictly avoided.

(9) This can be expressed in terms of a function of x such as $\exp[\gamma x^n]$.
(9) This can be expressed in terms of a function of x of the form $\exp[\gamma x^n]$.
(10) This is believed to be a bound state, and we represent it by a gauge invariant state such as $\langle \bar{q}_2 \Phi(C) q_1 \rangle_0$.
(10) This is believed to be a bound state, and we represent it by a gauge invariant state of the form $\langle \bar{q}_2 \Phi(C) q_1 \rangle_0$.
(11) It should be noted that if we replace M by a matrix in flavor space such as $\mathbf{M} = a\mathbf{1} + b\tau_3$, the analysis becomes much simpler.
(11) It should be noted that if we replace M by a matrix in flavor space of the form $\mathbf{M} = a\mathbf{1} + b\tau_3$, the analysis becomes much simpler.
(12) In the three regimes, G scales with τ such as $\tau^{1/2}$ (for $\sigma < \sigma_0$), $\tau^{1/3}$ (for $\sigma_0 < \sigma < \sigma_1$) and $\tau^{2/3}$ (for $\sigma > \sigma_1$).
(12) In the three regimes, G scales with τ as follows: $\tau^{1/2}$ (for $\sigma < \sigma_0$),

$\tau^{1/3}$ (for $\sigma_0 < \sigma < \sigma_1$) and $\tau^{2/3}$ (for $\sigma > \sigma_1$).

(13) The symmetries of the various solutions change such as the following:

(13) The symmetries of the various solutions change in the following manners:

The original sentences here are not without meaning, but these meanings are quite strange (and clearly differ from those intended by the authors). In each case, the role played by "such as" of introducing an example is inappropriate. For example, written more explicitly, the meaning of (9) is as follows: *This can be expressed in terms of a function of* x*. One representative example of such a function is* $\exp[\gamma x^n]$. This is obviously not what the author wished to assert.

118.2.4 Misused to mean *including*

The meanings of *such as* and *including* are quite close, but in cases like those considered below, the latter is more appropriate.

(14) This approach has proven to be useful in a number of disparate fields, such as solid state physics, molecular biology and linguistics.

(14) This approach has proven to be useful in a number of disparate fields, including solid state physics, molecular biology and linguistics.

(15) Several calculational techniques, such as path integration and renormalization group analysis, have been applied to this problem, but none to this time has succeeded.

(15) Several calculational techniques, including path integration and renormalization group analysis, have been applied to this problem, but none to this time has succeeded.

Although "such as" is not wrong in the above examples, "including" seems more natural. This is due to the fact that, while *such as* is generally quite neutral in the sense that the examples it introduces are not understood as necessarily being any more or less significant than any other examples, *including* seems to indicate that the examples it introduces are, in some way, of special interest. In (14), it appears that the author wishes to emphasize the disparate nature of the particular fields cited as examples. For the reason just described, this emphasis is provided more naturally by "including." In (15), the intended implication seems to be that path integration and renormalization group analysis are particularly powerful or general techniques. The author apparently wishes to convey the idea that even these methods have failed.

118.2.5 Superfluous use

Occasionally I find *such as* used when nothing is needed. The following typify such misuse.

(16) There are three common experimental techniques such as dielectric measurement, PALS and ellipsometry.

(16) There are three common experimental techniques: dielectric measurement, PALS and ellipsometry.

(17) The basic performance of the fiber-bundle such as measured by light yield and attenuation length is greatly improved.
(17) The basic performance of the fiber-bundle measured by light yield and attenuation length is greatly improved.
(17*) The basic performance of the fiber-bundle, as measured by light yield and attenuation length, is greatly improved.
(18) Two types of the activity control mechanism such as an optimized uniform threshold and a global inhibitory interaction are investigated.
(18) Two types of activity control mechanisms, an optimized uniform threshold and a global inhibitory interaction, are investigated.
(19) In our simulations, we found several characteristic structures of membranes, such as thermal fluctuations, large localized deformations, and undulations caused by curvature instability.
(19) In our simulations, we found several characteristic structures of membranes, namely, thermal fluctuations, large localized deformations, and undulations caused by curvature instability.
(19*) In our simulations, we found several characteristic structures of membranes, including thermal fluctuations, large localized deformations, and undulations caused by curvature instability.

In (16), "three common experimental techniques" is equivalent in meaning to "dielectric measurement, PALS and ellipsometry." As demonstrated here, in an expression of the form *A such as B*, if B consists of a list of examples that together constitute A in its entirety, then "such as" is inappropriate. In (17), it seems that the situation under consideration is that in which the "basic performance" is measured by only light yield and attenuation length. For this reason, again "such as" cannot be used. Note that the meanings of the two rewritten versions differ significantly. Example (18) is quite similar to (16). In (19), it seems that the list of structures given represents all of the structures found in the simulations. In this case, (19) expresses the intended meaning. However, if indeed other characteristic structures were found, something like (19*) would be appropriate.

118.2.6 Misuse with *the*

Because *such as* is used to introduce examples, use of *the* in the manner demonstrated below is not possible.

(20) We have obtained the two minimal models, such as Z_2 and $U(1)$.
(20) We have obtained the two minimal models, Z_2 and $U(1)$.
(20*) We have obtained the two minimal models Z_2 and $U(1)$.
(20**) We have obtained two minimal models /analogous to/similar to/corresponding to/ Z_2 and $U(1)$.
(21) This suggests that the physical quantity such as the ratio of the Newton constant and τ is gauge independent.
(21) This suggests that certain physical quantities, such as the ratio of the Newton constant to τ, are gauge independent.
(21*) This suggests that the physical quantity represented by the ratio of the Newton constant to τ is gauge independent.

In the original sentences here, the problematic use of "the" involves the nouns "models" and "quantity." There are two possible interpretations of the meaning imparted by "the" in (20). In the first interpretation, its use implies that there are only two minimal models in the present context. However, "such as" contradicts this, as it connotes that Z_2 and $U(1)$ are representative of further examples. The meaning intended in this case is expressed correctly by (20). In the second interpretation, "the" is used to indicate that "minimal models" refers identically to "Z_2 and $U(1)$." (This does not necessarily imply that these are the only minimal models.) Once again, however, this meaning is in contradicted by that of "such as." In this case, (20*) would be appropriate. Another possible interpretation of the original is expressed by (20**). Note that with any of these interpretations, the misuse demonstrated by (20) is of the type considered in (16)–(19). The assertion in (21) is even more unclear. The most plausible understandings are expressed by (21) and (21*). In the case that the intended meaning is that of (21*), the misuse here is also of the type considered in (16)–(19).

118.2.7 Problems with commas

Depending on the meaning with which it is used, in some cases *such as* should be preceded by a comma, and in some cases it should not. Examples (1) and (2) of Section 1 illustrate these two situations. When *such as* is preceded by a comma, the phrase it introduces is termed 'non-restrictive' or 'non-defining', and when it is not preceded by a comma, this phrase is termed 'restrictive' or 'defining'. The difference between such cases can be understood from the following.

> (22) Physically relevant perturbations such as those considered above must be treated carefully.
> (23) Physically relevant perturbations, such as those considered above, must be treated carefully.

In (22), "such as those considered above" restricts the meaning expressed by "physically relevant perturbations," and in so doing it limits the scope of this sentence to just perturbations of the kind considered "above." Contrastingly, in (23), "such as those considered above" is in some sense external to the main statement of the sentence (because it is separated from it by commas), and for this reason it does not limit its scope. The meaning of this sentence is that physically relevant perturbations in general must be treated carefully, while the perturbations "considered above" are simply offered as examples of physically relevant perturbations. In (22), "such as those" is similar to *of the kind*, and in (23), "such as" is similar to *for example*.

Missing comma

As demonstrated by the above examples, when the intention is to use *such as* with a meaning close to that of *for example*, it must be preceded by a comma. If the comma is omitted, such a meaning will not be expressed. This problem is seen in the following.

(24) Several methods have been proposed to determine this value, but they all involve complicating factors such as observational bias and the evolution effect.
(24) Several methods have been proposed to determine this value, but they all involve complicating factors, such as observational bias and the evolution effect.
(25) The Milnor attractors are preserved by changing other system parameters such as the connection strength of synapses and input biases.
(25) The Milnor attractors are preserved by changing other system parameters, such as the connection strength of synapses and input biases.

The meaning expressed by (24) is that all the complicating factors are of the same type as either observational bias or the evolution effect, but it is fairly clear that the author intended these to simply represent examples, without an implication regarding the nature of the complicating factors in general. The situation in (25) is similar.

Superfluous comma

Now, contrast (24) and (25) with the sentences below.

(26) The properties of functions, such as $\rho(x)$ have been studied in the context of measure theory.
(26) The properties of functions /like/similar to/in the same class as/ $\rho(x)$ have been studied in the context of measure theory.
(27) However, physical systems, such as the one described by (1.5), are in some sense non-generic.
(27) However, physical systems /like the one/with properties similar to those of the system/exhibiting behavior like that of the system/ described by (1.5) are in some sense non-generic.

In the original sentences here, "such as" is incorrectly used in non-restrictive phrases. The resulting expressions are quite inappropriate. The meaning of (26) is expressed more clearly by the following: *The properties of functions have been studied in the context of measure theory, and $\rho(x)$ is one such example.* While this statement may be true, it is very strange. Example (27) is even more unnatural, as it seems to be asserting that physical systems in general are non-generic.

Chapter 119

such as, *so as*, *such that*, *so that*

The four expressions *such as*, *such that*, *so as* and *so that* are quite often confused. While their meanings are somewhat similar, in general they cannot be used interchangeably. In the following sections I discuss each separately.[1]

119.1 *such as*

As discussed in Chapter 118, *such as* has several uses. Most commonly, it is used to introduce examples. This use is demonstrated by the following.

> (1) However, these effects can be ignored in all but some very unusual situations, such as when $|\omega_1 - \omega_2| < \epsilon^2$.
> (2) During the experiments, a thick layer of insulating material was wrapped around the tube to minimize certain undesirable effects, such as the loss of heat to the external environment.

While *such as* and *for example* are very similar in meaning, there is one important difference: More than simply indicating that those things which follow are examples, *such as* also includes the implication that they are somehow representative of a certain *class* of things that share some characteristic by virtue of which they are all examples.

119.2 *so as*

This expression is synonymous with *for the purpose of* or *in such a manner that*, as seen below.

> (1) During the experiments, a thick layer of insulating material was wrapped around the tube so as to minimize the loss of heat to the external environment.

[1] For related discussion, see Chapters 116 and 118.

Note that *so as* almost always appears before a *to + [infinitive verb]* structure (in (1), "to minimize").[2] In the present case, "so as to minimize" modifies the verb "wrapped." Usually, the meaning of such a sentence is changed little if *so as* is deleted, but in general it serves to express the idea that the action in question was carried out in a particular manner chosen to bring about the desired result.

119.3 *such that*

The expression *such that* is used in the modification of nouns. It usually expresses a meaning something like *of a type that* or *with the property that*, as seen below.

> (1) During the experiments, a thick layer of insulating material was wrapped around the tube in a manner such that the loss of heat to the external environment was minimized.

In this example, note that "such that..." modifies the noun "manner."[3] The implication is that the manner in which the insulating material was wrapped is of some particular type specifically designed to minimize heat loss. In the above sentence, it is important to note that "such that..." does does not modify the verb "was wrapped." There is a common misconception that *such that* is used in the modification of verbs. This results in some very strange sentences, such as the following.

> (2) In our preliminary study [3], we ignored the convection term such that we could easily determine the behavior in the small γ regime.

Here, the intended meaning is that the convection term was ignored to allow for determination of the behavior in question, but because grammatically "such that..." can only be interpreted as modifying "term," the actual meaning of the sentence is quite unnatural. The simplest way to remedy this problem is to replace "such that" with *so that*. If this is done, the phrase "so that we..." acts correctly as an adverb, modifying "ignored."[4]

119.4 *so that*

So that is usually used to express a meaning similar to those of *for the purpose of* and *in order that* (in which case it generally is not preceded by a comma) or those of *with the consequence that* and *and therefore*[5] (in which case it generally is preceded by a comma). Consider the following correct usage.[6]

[2]Grammatically, in general, a phrase of the form *so as + [infinitive clause]* acts as an adverb (a so-called 'adverbial phrase'). This infinitive clause can consist of a *to + [infinitive verb]* structure alone or something more complicated.

[3]More precisely, "such" is an adjective modifying "manner," and it is joined to the complementary subordinate clause "the loss of..." by the conjunction "that."

[4]For further comparison of *such that* with *so that*, see Section 1 of Chapter 116.

[5]However, as discussed in Section 3 of Chapter 116, even in this second usage, there are situations in which *so that* cannot be used as a synonym of *therefore*.

[6]For examples of its incorrect usage, see Sections 1, 2 and 3 of Chapter 116.

(1) During the experiments, a thick layer of insulating material was wrapped around the tube, so that the loss of heat to the external environment was minimized.

The meaning of "so that" in this sentence is quite similar to *and therefore*, but there is also an implication of purposefulness; that is, here it is implied that the insulating material was wrapped around the tube with the purpose of obtaining the stated result. Note that, in general, *so that* and *so as* are similar in meaning, but not synonymous. Also, grammatically they play different roles.[7] Here, removing the comma appearing before "so" would drastically change the meaning of the sentence (and, without further change, result in a semantically inconsistent assertion). In this case, the meaning of cause-effect expressed by the original would be lost, and the sentence would be entirely an assertion regarding the purpose of wrapping the tube with a thick layer of insulating material. However, in order to correctly change the meaning in this way from a statement of fact to a statement of intention, the verb "was" would have to be changed to *would be*.

Compare (1) with the following.

(2) These somewhat involved steps were taken so that it would not be necessary to remove the sample from the chamber after it was heated.

In this sentence, "so that" is synonymous with *in order that*. Note that if a comma were inserted before "so that," the meaning of this sentence would become that of the following: *These somewhat involved steps were taken. As a result, it would not be...* This is obviously nonsense. It could be made meaningful by changing "would not be" to *was not*, but the result would still be somewhat strange.

[7] The expression *so as* is used to introduce a infinitive adverbial clause, whereas *so that* is used to introduce a finite adverbial clause.

Chapter 120

that vs. *this*

The adjective *that* is quite often used by Japanese authors when *this* is more appropriate. (For some reason, the opposite problem is much less common.[1]) While these words can often be used interchangeably, there is an important difference in meaning: *that* connotes remoteness, while *this* connotes closeness. For this reason, *this* is appropriate when the noun being modified is central to the present discussion, that is, when that represented by this noun is understood to be the object currently presented 'before the reader's eyes'.

120.1 Mistaken use of *that* in place of *this*

The following are typical examples of the misuse of *that* for *this*.

> (1) The system of equations given above exhibits only simple periodic oscillation of frequency ω_0 with the two components perfectly out of phase. That behavior can be easily understood from the intuitive argument given below.
> (2) We now consider the equation $\psi_{t+1} = F[\psi_t]$. As we show in this section, if we add a certain type of small perturbation to that equation, very interesting behavior can be seen.
> (3) Here, in contrast to the previous case, it is not necessary to assume the differentiability of f. That point is discussed further in Section V.
> (4) Now, we take the limit $p \to 0$ and find two distinct peaks in the distribution $\phi(\rho)$. Therefore, in that case, the simpler approach is sufficient to obtain the desired result.
> (5) We obtain the desired result by first 'smoothing' the solution $u(x)$ of (4.3) using the method described above. That yields a function of the form $\tilde{u}(x) = \sum_{i\in\sigma} c_i v_i(x)$, with no more than N critical points in the interval (a, b). With that form, the value of γ in each case can be easily evaluated by taking the direct product of $\tilde{u}(x)$ with the appropriate basis element. That procedure for obtaining the values of γ is depicted schematically in Fig. 2.

[1] Perhaps this is due to the fact that the realm of applicability of *this* is broader than that of これ and この.

(6) The type of mechanism considered here has to this time exclusively been associated with single-cell organisms. As we have reported in this paper, however, it also appears in organisms of such highly developed classes as Mammalia and Reptilia. The task we now face is to determine just how the functioning of the mechanism differs in the more complex organisms of those classes.

In (1)–(5), "that" should be replaced by *this*. (This applies to all three appearances of "that" in (5).) In (6), "those" should be replaced by *these*. The important point here is that, in each case, the noun modified by the adjective "that" or "those" ("behavior" in (1), "equation" in (2), "point" in (3), "case" in (4), "form" and "procedure" in (5), and "classes" in (6)) or the gerund referred to by the pronoun "that" ("smoothing" in (5)) expresses something which is regarded as a present focus of discussion. In this sense, it exists in the foreground.

The problem seen in (1) is quite typical. Here, because the "behavior" in question has been described immediately before the appearance of this word, it is understood as being situated directly in front of the reader. The remaining examples are similar. It is fairly clear why "that" is inappropriate in all cases here, except perhaps in (6), which warrants some discussion. Apparently, this sentence appeared at the end of a paper in which the classes Mammalia and Reptilia constitute one of the central themes. For this reason, these classes evidently exist 'just before the reader's eyes' from the beginning of the paper to the end. Therefore, "those" is inappropriate here.

120.2 Correct use

The important point in determining the relative appropriateness of *this* and *that* regards the 'distance', within the present discussion, that the reader perceives as separating him from the noun in question. To understand this distinction, it is useful to first compare the above examples with the similar examples below demonstrating proper uses of *that*.

(1) The system of equations studied in the previous section exhibits only simple periodic oscillation of frequency ω_0 with the two components perfectly out of phase. As seen above, that behavior can be easily understood from an intuitive argument. We now consider a more complicated situation.
(2) Let us compare the equation

$$\psi_{t+1} = F[\psi_t]$$

to (2.2). It was found above that if we add a certain type of small perturbation to that equation, very interesting behavior can be seen. Now we see that quite different behavior is exhibited in the present case.
(3) In the previous case, the key point was the differentiability of f. That point is irrelevant in the present case.
(4) In the next section, we take the limit $p \to 0$ and find two distinct

peaks in the distribution $\phi(\rho)$. Therefore, in that case, the simpler approach is sufficient to obtain the desired result.

(5) Previously, we obtained the desired result by first 'smoothing' the solution $u(x)$ of (4.3) using the method described in Sec. 1. That yielded a function of the form given in (1.2), with no more than N critical points in the interval (a, b). With that form, the value of γ in each case was easily evaluated by taking the direct product of $\tilde{u}(x)$ with the appropriate basis element. Let us now contrast that procedure with the procedure used presently, which is depicted schematically in Fig. 2.

(6) We have considered this mechanism only in the context of single-cell organisms. However, similar mechanisms are known to exist in such highly developed classes as Mammalia and Reptilia. The task we now face is to determine just how this type of mechanism differs in the more complex organisms of those classes.

Note that in each of the sentences here, "that" is used in reference to something that is *not* the present focus of discussion.

Next, let us consider the sentence below.

> (7) /That/This/ equation possesses a special type of symmetry that can be exploited to obtain exact steady-state solutions in several regimes.

The first point to note is that in order for either "that" or "this" to be appropriate, the equation referred to here must have appeared or been discussed just prior to this sentence.[2] Now, to determine whether "that" or "this" is correct, we must ask if this equation exists in the foreground or background of the present discussion. In order to answer this, it is necessary to consider the context of the sentence. Below I present several possible cases.

First, suppose that the sentence in (7) appears as follows.

> (8) We have thus seen that Eq. (2.1) cannot be solved in the most general case using the standard techniques. However, as we show below, this equation possesses a special type of symmetry that can be exploited to obtain exact steady-state solutions in several regimes.

In this case, the "equation" in question is clearly the central topic both in these sentences and in the discussion leading up to them. For this reason, "this" must be used here.

Next, consider the following.

> (9) While we now consider a much more complicated situation, it is helpful to again consider the situation involving Eq. (1.1). That equation possesses a special type of symmetry that can be exploited to obtain exact steady-state solutions in several regimes.

[2] If this is not the case, then a more descriptive modifier is needed. In fact, such inappropriate use of *that* and *this* is not uncommon.

The situation here is somewhat more subtle. The reason why "that" should be used in this case is that the context of the present discussion is one of a "more complicated situation," and Eq. (1.1) does not exist in this context. Here, the reader is situated within the "more complicated situation" and looking at Eq. (1.1) from afar.

Finally, let us consider the situation described below.

> (10) The equation we study in this paper, Eq. (2.1), has been treated with several methods, including that developed by Jones to treat the similar Eq. (1.1) of Ref. [2]. /That/This/ equation possesses a special type of symmetry that can be exploited to obtain exact steady-state solutions in several regimes.

In this situation, either "that" or "this" could be used, but they would impart different meanings. Here, "this equation" would refer to that which exists in the present discussion, Eq. (2.1), while "that equation" would refer to that which does not, Eq. (1.1).

Chapter 121

the vs. *this*

The roles played by the article *the* and the adjective *this* in introducing nouns are different. I often find *the* misused in place of *this*.

The definite article *the* is used to express the idea that the noun (plus modifiers) it introduces uniquely identifies a single thing within the present context. By contrast, the adjective *this* is used to express the idea that the noun it introduces refers to that thing presently situated in the foreground of the discussion. Thus, *the* implies uniqueness, while *this* implies closeness to the reader. Although there are situations in which either of these can be used, there are many more in which only one is appropriate. The problem that I usually encounter results from the use of *the* when the noun in question refers to something that is in the foreground of but not unique in the present context.[1] This misuse is particularly common in situations like those illustrated by the following examples, in which that to which the noun in question refers is introduced just prior to the misuse of "the."

(1) We begin by considering the equation $\Gamma[z] = u(z)$. The equation is treated with the method described above.
(1) ...This equation is then treated with the method described above.
(2) The difference of these terms, $\Delta\tau(x)$, possesses a very simple form. In Fig. 3, the form is plotted on the interval of interest.
(2) ...In Fig. 3, this form is plotted on the interval of interest.
(3) Our experiment was performed under a somewhat unusual set of conditions. The conditions are described in detail in Appendix A.
(3) ...These conditions are described in detail in Appendix A.
(4) We propose a new general method to reduce equations of this class to simpler forms. The method is a somewhat improved form of that developed in Ref. [1].
(4) ...This method is a somewhat improved form of that developed in Ref. [1].
(5) The effect of this modification on the angular dependence of the scattering amplitude has been studied by Brown [2] and Holmes et al. [3], and they found that the effect is negligible up to energies of approximately 900 MeV.

[1] The mistaken use of *this* for *the* is quite rare.

(5) ...and they found that this effect is negligible up to energies of approximately 900 MeV.

(6) In Ref. [3], an approximate expression is obtained for the form of $\phi(x, a, b)$ with $a = 1$ in the limit $b \to 0$. Here we derive an exact expression for the form.

(6) ...Here we derive an exact expression for the form of $\phi(x, a, b)$ in the general case.

(6*) ...Here we derive an exact expression for this form.

These examples demonstrate the most common type of misuse of *the* for *this*. Note that in each case here, in the first sentence (or clause), some object to become the focus of discussion (namely, an "equation," a "form," "conditions," a "method," an "effect" and a "form") is introduced, and in the second sentence (or clause), "the" precedes the noun referring to this thing. It appears that the authors of these sentences understood these to be the unique equation, form, conditions, method, effect and form within the context of the present discussion. This is a misconception. Clearly, however, because each of these has just been introduced, it is in the foreground of the discussion – existing (in some cases literally) before the reader's eyes. For this reason, "this" (or "these") is appropriate in each case.

In order to understand the misconception leading to the mistakes in the above original examples, let us consider (1). Because the first sentence there singles out a particular equation as the equation of interest, it may seem that this sentence narrows the context of the discussion to this equation alone. If this were the case, then "the equation" in the second sentence would be appropriate. The situation, however, is not so simple. Indeed, the recent introduction of some thing as the focus of our attention is not sufficient to make this thing unique in the sense necessary for the use of *the*. Actually, in general, the fact that there is a need to make such an introduction implies the opposite. For example, in (1), the fact that it was necessary to explicitly identify "$\Gamma[z] = u(z)$" as the equation of interest implies that this *cannot* be the unique equation in the present context. It is the misunderstanding of this point that underlies the problem studied in this chapter.

Let us end by restating the distinction between the *the* and *this*. The article *the* can be used only when the noun (plus modifiers) that it introduces singles out one particular thing within the present context. In general, the fact that some particular thing has been introduced as the present focus of discussion is not sufficient to establish such uniqueness. In the case that a noun refers to something that is not unique but is the present focus, it should be modified by *this* (or *these*).

Chapter 122

then

The adverb *then* is frequently misused in two ways.

122.1 Misused as a conjunction

I often find *then* used as a conjunction to join two independent clauses. Such use is grammatically incorrect. The following are typical.

> (1) In more complex systems, order parameters may be functions of space and time, then the macroscopic description is meaningless.
> (1) In more complex systems, order parameters may be functions of space and time, in which case the macroscopic description would be meaningless.
> (1*) In more complex systems, order parameters may be functions of space and time. In this case the macroscopic description would be meaningless.
> (2) Let $\phi_c(\mathbf{r})$ represent the minimum of (3.1), then $N\,|\phi_c(\mathbf{r})|^2$ is the number density at zero temperature.
> (2) Let $\phi_c(\mathbf{r})$ represent the minimum of (3.1). Then $N\,|\phi_c(\mathbf{r})|^2$ is the number density at zero temperature.
> (3) Due to the feedback from the smaller subsystem, the larger subsystem may become unstable, then the stability of the smaller subsystem can change.
> (3) Due to the feedback from the smaller subsystem, the larger subsystem may become unstable, and as a result the stability of the smaller subsystem can change.

In all of the originals here, "then" is being misused to connect two independent clauses. Only a conjunction can play such a role. Note that in (1), the clause "in which case..." is a dependent clause.

122.2 Misused in place of *thus*, *therefore*, *hence*, etc.

When the ideas expressed by two consecutive clauses or sentences are connected by logical or causal implication, they should not be joined by *then*. Note that (3) in the previous section demonstrates misuse of this type. Below I present additional typical examples.

> (1) These quantities vanish in the $t \to \infty$ limit. Then the meaning of this expression is lost.
> (1) These quantities vanish in the $t \to \infty$ limit, and thus in this limit the meaning of this expression is lost.
> (1*) These quantities vanish in the $t \to \infty$ limit. Thus in this limit, the meaning of this expression is lost.
> (2) However, substituting this form into the original equation, we find that it is not a solution. Then we conclude that the analysis has failed.
> (2) However, substituting this form into the original equation, we find that it is not a solution. Therefore we conclude that the analysis has failed.
> (2*) However, substituting this form into the original equation, we find that it is not a solution. /Thus/Hence/ the analysis has failed.
> (3) In the present case, the assumption made above is not valid, and here the average $\langle H[f, df/d\phi]\rangle$ must computed exactly. Then the procedure for obtaining ξ becomes extremely complicated.
> (3) In the present case, the assumption made above is not valid, and here the average $\langle H[f, df/d\phi]\rangle$ must computed exactly. /Therefore/For this reason/As a result/Consequently/, the procedure for obtaining γ becomes extremely complicated.

Chapter 123

thus, *therefore*, *hence*

In this chapter, I discuss the use and misuse of the adverbs *thus*, *therefore* and *hence*. In the next section I compare these words, and in the second section I consider their misuse.

123.1 Comparison of *thus*, *therefore* and *hence*

The adverbs *thus*, *therefore* and *hence* can be used to express connections of causation and logical implication of several kinds. Although, when used in this way, these words are usually close in meaning and often can be used interchangeably, they do have important differences.[1] Because I frequently find one of these words used when one of the others would be more appropriate, it is worth discussing their differences.[2]

123.1.1 *thus*

Among these three words, the meanings unique to *thus* are *in /this/that/ way* and *with /this/that/ /fact/situation/result/*. These meanings are demonstrated by the following.

> (1) However, substituting (2.5) into the original equation, it is immediately found that this is not a solution. Thus we see that the analysis has failed.
> (2) If initially we have $\langle C\rangle = \langle D\rangle = \hat{\rho}$, $\langle A\rangle = \rho_0$ and $\langle E\rangle = 0$, the following behavior is observed. From the initial time, $\langle A\rangle$ increases, and as it does, $\langle C\rangle$ and $\langle D\rangle$ decrease, eventually causing the concentration of $\langle E\rangle$ to become non-zero. When this happens, $\langle A\rangle$ begins to decrease, with $\langle C\rangle$ and $\langle D\rangle$ increasing again. When $\langle A\rangle$ reaches the value ρ_0, $\langle E\rangle$ drops immediately to zero, and $\langle C\rangle$ and $\langle D\rangle$ jump immediately to $\hat{\rho}$. Thus in this case the system exhibits simple periodic behavior.

[1] Each of these has meanings other than those indicating causation and logical implication, but such meanings are not considered here.

[2] In the papers that I proofread, it often seems that to express the meanings of such terms as だから, 従って and ... ゆえに, the authors simply choose randomly from among *thus*, *therefore* and *hence*. This can lead to problems.

(3) However, when nucleation begins, a difference between $\langle\psi\rangle_L$ and $\langle\psi\rangle_R$ will spontaneously arise, and due to the long-range effect, this difference will gradually grow, with one value approaching 2/3 and the other 1/3. Thus the original symmetry comes to be broken.
(4) Substituting (2.4) into (2.1), we find $\gamma = 0$. Thus the theorem is proven.

In each of the above examples, while "thus" does express connections of causation (in (1)) and logical implication (in (2)–(4)), its meaning is very close to *in this way* and, in some cases, *with this /fact/situation/result/*. In (1), the "finding" that "(2.5)" is not a solution is equivalent to the "seeing" that the analysis fails, and thus the first sentence here truly describes the way in which or the fact or result from which we "see" the conclusion. The situation is similar in (2). Here, that which appears up to the last sentence is a depiction of this "simple periodic motion" and the manner in which it comes about. The first sentence in (3) is a description of the way in which the symmetry in question comes to be broken, and so here too "thus" is synonymous with *in this way.* Again in (4), the meaning expressed by "thus" is clearly something like *in this way* or *with this /fact/result/.*

In (1) and (2), using *therefore* and *hence* would result in fairly unnatural assertions. If we were to replace "thus" with *therefore* in (1), the resulting meaning would be that finding that (2.5) does not solve the original equation is the *reason* that we see that the analysis fails. Of course, it cannot be said that this is incorrect, but this is a somewhat convoluted and inappropriate line of reasoning. Clearly, the meaning expressed by "thus" – that finding that (2.5) does not solve the equation is equivalent to seeing that the analysis fails – more accurately describes the actual situation. If we were to use *hence* in place of "thus," the meaning would be that finding that (2.5) does not solve the original equation logically *implies* that we see that the analysis fails. Again, although this certainly cannot be deemed false, its line of reason is somewhat cumbersome and unnatural. In (2), the meanings that would be conveyed by *therefore* and *hence* – that the fact that the system exhibits periodic motion is a *result* of the behavior described in the second sentence and that this fact is a *logical implication* of this behavior – are even more inappropriate than in (1) and clearly misrepresent the actual relationship. The situation in (3) is very similar. In (4), *hence* would be as appropriate as "thus," (although the nuance would change slightly), while *therefore* would be quite unnatural.

Often *thus* is used to introduce a result or consequence, as in (1) above. When it does so, because it contains the meanings of *in /this/that/ way* and *with /this/that/ /fact/situation/result/*, it usually expresses the idea that this result or consequence follows naturally and unavoidably. For this reason, while *thus*, *therefore* and *hence* can all be used as synonyms of *as a result*, the meaning of *thus* in such a situation is stronger and, in fact, closer to *as a necessary result.*

Of the meanings possessed by these three words, those which *thus* lacks are *for this reason*, expressed most strongly by *therefore*, and *as an /inference/deduction/*, expressed most strongly by *hence*. Therefore uses like that demonstrated below should be avoided.

(5) We must demonstrate that X is a compact space, and thus we at-

tempt to prove that every infinite set has an accumulation point.
(6) The repeated twisting causes the filament to weaken, and thus it breaks before $t = t_0$.
(7) However, the elements of S cannot be put into one-to-one correspondence with the integers, and thus S is not countably infinite.
(8) We assume that $S < \tau_0$. Then, from (3.5), we obtain $B = 0$. However, applying Theorem 2.1, this clearly leads to a contradiction. Thus, $S \geq \tau_0$.

In (5) "thus" seems to imply that our attempting to carry out such a proof follows as a necessary result of the need to demonstrate that "X" is compact. There are two problems with this. First, it is unrealistic that our action would be determined in this way, and second, this is not the only way to prove compactness. Here, "thus" should be replaced by *therefore*, *for this reason*, *for this purpose*, *to this end* or something similar.

The assertion of (6) is that the weakening of the filament necessarily results in it breaking before the time t_0. This use of "thus" would be appropriate only in the situation that we knew with certainty that if the filament were weakened by any amount it would necessarily break before $t = t_0$. Except in such a very unnatural situation, "thus" should be replaced by *therefore*, *as a result*, *consequently* or *for this reason*, all of which lack the meaning of inevitability expressed by "thus."

The problem with (7) is that the apparent meaning of *as a result* expressed by "thus" is inappropriate; the fact that the set S is not countably infinite is not a *result* of the fact that it cannot be put into one-to-one correspondence with the integers. Rather, these conditions are logically equivalent. Here, either *hence* or *therefore* could be used, but *hence* is probably better.[3]

As in (7), the meaning of *as a (necessary) result* expressed by "thus" in (8) is inappropriate: The conclusion here does not follow as a result but, rather, as a logical implication of the preceding argument. Here *hence* is the best choice.[4]

123.1.2 *therefore*

That which distinguishes *therefore* from *thus* and *hence* is its very clear role of identifying the **reason** behind some result. In almost all situations, this word can be replaced by *for /this/that/ reason* without significantly altering the meaning. Although *thus* and *hence* are sometimes used to express meanings close to *for /this/that/ reason*, this is a very minor meaning for both words (especially for *thus*), and it is usually overwhelmed by their primary meanings. Accordingly, when the intention is to express a relation consisting of a result and the reason responsible for this result, it is usually better to use *therefore* than *thus* or *hence*. The following represent such situations.

[3] It is important to note here that there is no problem with the following type of expression: *This shows that..., and it is thus seen that...* Here, in contrast to (7), that which is understood as the *result* is not the fact that S is countably infinite itself but, rather, our understanding ("seen") of this fact.

[4] Note that, in analogy to (7), an expression of the type *Thus we find that $S \geq \tau_0$* would be possible here.

(9) In this case, the vibrational modes cannot be ignored, and therefore the treatment here becomes much more complicated.
(10) The velocity of the shear flow v could be measured to within only about 2%, and therefore the uncertainties on the values of m were too great to allow a meaningful comparison with the previous results.
(11) We seek a globally valid solution, and therefore we renormalize this expression.
(12) The full equation (4.1) cannot be treated directly, and we therefore begin by considering the following simplified form.

In each of these examples, the intended meaning is best expressed by "therefore." Here, the sense of logical implication imparted by *hence* and that of inevitability and/or closeness imparted by *thus* are, to varying degrees, inappropriate. Rather than an argument demonstrating the conclusion or implying the result expressed in the second clause, the first clause in each sentence consists of an explanation of the reason that such a conclusion or result is realized in the present case. Implicit here is the idea that it is not the case that such a reason necessarily yields such a conclusion or result. This use of *therefore* is discussed further in the next section.

In (9), if "therefore" were replaced by *thus*, the implication would be that the result of the treatment becoming more complicated follows directly and inevitably from the fact that the vibrational modes cannot be ignored. Although there may be situations in which this would indeed be the case, in general this seems to be too strong. The original has a much weaker meaning and allows the possibility that, although in the present case the treatment becomes more complicated, such complication could in principle be avoided, perhaps given a sufficiently powerful method. Using *hence* here would be even more unnatural, as it would yield the meaning that this complication of the treatment is implied logically by the fact that the vibrational modes cannot be ignored. In (10), *thus* and *hence* would both result in statements asserting inappropriately direct relations between the uncertainties on the values of v and m. The use of *thus* and *hence* would be even more unnatural in (11), as they would imply that our renormalization of the expression under consideration follows as an inevitable consequence and as a logical consequence of the fact that we seek a global solution. Clearly, however, because we are able to freely choose our own action, such is not the case. Here, our seeking a global solution is simply the reason or motivation behind the renormalization. This meaning is expressed by "therefore." In (12), using *thus* would give the implication that our inability to treat (4.1) necessarily results in our considering the "following simplified form." It would seem, however, that other possibilities exist (e.g., employing an indirect treatment or considering some other simplified form).[5] If we replaced "therefore" by *hence*, the resulting connotation would be that from the fact that we cannot treat (4.1), it follows logically that we consider the particular form in question.

Of the meanings that can be expressed by the words studied here, *therefore* lacks that of *in this way*, possessed by *thus*. For this reason, as alluded to above, when

[5]Use of *thus* would be much more natural in something like the following: *We cannot treat the full equation, and thus we begin by treating a simpler form.* In this case, the idea that we have no choice but to consider a simpler form seems reasonable.

therefore is used as a synonym of *as a result*, it does not convey the strong meaning of inevitability expressed by *thus*. The following demonstrate this point.

> (13) At the next order, however, the effect of the cross term appears, yielding a term proportional to $\cos^2(\omega_0 t)$ in the solution. Therefore a non-zero time average arises.
> (14) We wish to make measurements as close to v_0 as possible, but if we approach this value too closely, the probes themselves can cause the appearance of eddies, and therefore contribute to the very effect that we wish to measure.
> (15) The set of all functions f form a normed linear space F with respect to the norm $\langle f \rangle_\Omega$, as defined above. Therefore we define the norm of any bounded linear operator T on F as $\sup_{\langle f \rangle_\Omega \leq 1} \langle T_i f \rangle_\Omega$.

Use of "therefore" in (13) allows the interpretation that the term $\cos^2(\omega_0 t)$ leads somehow indirectly to a non-zero time average. However, it would appear that this term is the direct cause of this result. The correct meaning would be unambiguously expressed by *thus* or *hence*. Although these terms differ in nuance (with the meaning expressed by *thus* of a more causal nature and that expressed by *hence* of a more logical nature), both are appropriate here. (Note that *in this way* could also be used.)

The use of "therefore" in (14) would be appropriate if the effect we are trying to measure is not the appearance of eddies itself but something caused by this appearance. If, however, this effect is indeed the appearance of eddies, *thus* or *in this way* would be the best choice.

Although the use of "therefore" in (15) is not entirely inappropriate, it could lead to confusion. This sentence could be interpreted as meaning that, in consideration of the norm defined for a function $f \in F$, we have chosen to define the norm of an operator T in the stated form from multiple possible forms – perhaps because this form is most convenient. In fact, however, given the norm of the elements f, the norm of such a T is uniquely determined (assuming we employ the standard definition). *Thus* or *hence* would clearly express this meaning.

123.1.3 *hence*

That which distinguishes *hence* from *thus* and *therefore* is a strong meaning of logical implication. In this sense it is similar to the expressions *as an inference*, *as a deduction*, *it is implied that*, and sometimes *it follows that*. Among these three words, *hence* is the most natural when the assertions to be connected are related by pure logical implication. Although *therefore* can also be used in this role, because it has additional, stronger meanings, this use can sometimes lead to imprecision or ambiguity. This is seen in the examples below.

> (16) However, substituting (2.5) into the original equation, it is immediately found that this is not a solution. Hence the analysis has failed.
> (17) We need a globally valid (and hence renormalized) solution.
> (18) The two existing experimental results are $s = 3.3 \pm 0.4$ and $s =$

2.9 ± 0.3 [4,5]. Hence there is nothing to favor either of the theories, which yield $s = 3$ and $s = 16/5$, respectively.
(19) Assume $L_a = L_b$. Hence $\sigma = 0$, and γ is twice differentiable.

In (16), the meaning expressed by "hence" is that the fact that "(2.5)" is not a solution logically implies that the analysis has failed. This is a clear description the actual situation. Neither *thus* (suggesting that this failure of the analysis is a *result* of (2.5) failing to satisfy the equation) nor *therefore* (suggesting that (2.5) failing to satisfy the equation is the *reason* for the failure of the analysis) would express such a clear and direct logical connection. This sentence should be compared with (1), in which "thus" correctly expresses the idea that the "seeing" is a direct result of the "finding." In (16), by contrast, the connection is not of a cause and its result but of a fact and its logical implication.

The meaning expressed by (17) is that the renormalization of the solution is a necessary condition for the solution to be globally valid. If *therefore* or *thus* were used, the most natural interpretation of this sentence would be that the renormalization is a result of the global validity of the solution. These meanings are obviously very different.

Because the conclusion stated in the second sentence follows as a direct logical inference from the assertion of the first sentence, (18) is very similar to (16).

Both *thus* and *therefore* would give an undesired meaning in (19), because their use would imply that the relation $\gamma > 0$ is true. With "hence," on the other hand, the expressed meaning is simply that $\gamma > 0$ follows logically from $L_a = L_b$, without the implication that it is actually 'true'. In this sentence, "hence" is synonymous with *this implies that* and *it follows that*.

Hence lacks both the meanings of *in this way*, expressed by *thus*, and *for this reason*, expressed by *therefore*. This can be seen most clearly by considering the replacement of "thus" and "therefore" by *hence* in (1)–(4) and (9)–(12).

123.2 Misuse

123.2.1 Problems of logic

As discussed in the previous section, *thus*, *therefore* and *hence* can be used to express connections of causation and logical implication of many kinds. However, it is not the case that such a meaning can in every situation be appropriately expressed by one of these words. This point is demonstrated by the examples given here. Below I treat two types of misuse involving problems of logic.

type 1 problem: **Used in** *[premise/cause/reason] + thus/therefore/hence + [conclusion/result]* **structure that does not play the role of demonstrating** *[conclusion/result]*

In the usage considered in the present chapter, *thus*, *therefore* and *hence* appear in constructions of the form *[premise/cause/reason] + thus/therefore/hence + [conclusion/result]*, where *[conclusion/result]* is something that follows either logically or causally from *[premise/cause/reason]*. One important point regarding such usage of

these words is that their role is to present a conclusion or result that is demonstrated by the *[premise/cause/reason] + thus/therefore/hence + [conclusion/result]* structure itself. I often find *thus*, *therefore* and *hence* misused in the situation that the causal or logical connection between *[premise/cause/reason]* and *[conclusion/result]* is in fact not established by the argument contained within this structure. (Below, this type of problem is referred to as *type 1*.) The most common such misuse occurs when *[premise/cause/reason]* is *not* an assertion from which *[conclusion/result]* can be deduced but, rather, an explanation of why such a conclusion or result (whose demonstration is perhaps given elsewhere) is reasonable. The following is such an example.

> (1) The curve obtained by solving Eq. (4.1) numerically, $g_{\mathrm{num}}(x)$, and that obtained by solving the approximate form Eq. (4.2) analytically, $\tilde{g}(x)$, are displayed in Fig. 4. The non-linear term in Eq. (4.1) dominates the long-time behavior of this equation, and therefore these curves possess completely different forms.
> (1) ...Because the non-linear term in Eq. (4.1) dominates the long-time behavior of this equation, these curves possess completely different forms.
> (1*) ...The reason that these curves possess completely different forms is that the non-linear term in Eq. (4.1) dominates the long-time behavior of this equation.
> (1**) ...The non-linear term in Eq. (4.1) dominates the long-time behavior of this equation, and therefore the difference between these curves seen in the figure is reasonable.

The intention of the author here was apparently to use the clause "the non-linear... equation" as an explanation of why the situation described by "Fig. 4" is understandable. However, with this interpretation, "therefore" is being used to introduce a conclusion (i.e., the fact that the forms of these curves are completely different) that is not demonstrated by the *[premise/cause/reason] + therefore + [conclusion/result]* structure itself but, instead, by Fig. 4. Because *thus*, *therefore* and *hence* cannot be used in such a manner, there is only one possible way to literally interpret the second sentence of (1). In this interpretation, this sentence expresses the idea that the fact that the non-linear term dominates the long-time behavior implies that the forms of these curves are completely different; that is, this fact somehow allows us to construe Fig. 4 in such a way that we are able to surmise this difference. Clearly, however, this is not the intended meaning. In the first two rewritten versions, it is evident that the statement about the importance of the non-linear term is only an explanation making understandable the fact demonstrated by the figure. In (1**), the conclusion introduced by "therefore" is not that the curves are different but that their difference is reasonable.

type 2 problem: Used in statements with uncertain causation or implication

Above, I discussed misuse in which the *[premise/cause/reason] + thus/therefore/hence + [conclusion/result]* structure itself is not used in the role of demonstrating the conclusion or result in question. Here, I consider misuse in which this structure is indeed

used in such a role, but the logical or causal connection it expresses is not certain. This is the second common misuse of *thus*, *therefore* and *hence*. (Below, this type of problem is referred to as *type 2*.) In general, when these adverbs are used, it must be certain that the stated result or conclusion follows from the stated premise, cause or reason. I frequently encounter their misuse when this is not the case. Most often, this misuse occurs in the situation that the expressed cause of some resulting situation is a plausible but not certain cause. Below, I present some examples illustrating this problem. Before doing so, however, I make a clarifying comment to avoid any possible misunderstanding. In the previous section, I made the point that *therefore* can be used in the situation that the stated result does not follow inevitably from the stated cause. However, even when *therefore* is used in this manner, it must be the case that in the particular situation under consideration, the causation or implication *is* certain. Thus the lack of inevitability discussed there is not due to a lack of actual certainty. Rather, it is due to the lack of a direct connection between the cause and result and the fact that *in general* it may not be the case that such a cause necessarily leads to such a result.

Examples

The examples below demonstrate problems of the two types discussed above.

> (2) The number of data points is still quite small, and therefore the values we obtain for the mass using the two methods of measurement are not consistent.
> (2) The number of data points is still quite small. This seems to be responsible for the inconsistency between the values we obtain for the mass using the two methods of measurement.
> (2*) The number of data points is still quite small. We believe this is the reason that the values we obtain for the mass using the two methods of measurement are inconsistent.
> (2**) The number of data points is still quite small. We attribute the inconsistency of the masses obtained using the two methods to this fact.
> (3) However, an important source of error has not been accounted for, and therefore the experimental value, $\tau^{0.9\pm0.2}$, is inconsistent with the theoretical value, $\tau^{3/2}$
> (3) However, an important source of error has not been accounted for, and this may be responsible for the inconsistency of the experimental value, $\tau^{0.9\pm0.2}$, and the theoretical value, $\tau^{3/2}$.
> (4) However, an important source of error has not been accounted for, and therefore the experimental value derived below is inconsistent with the theoretical value, $\tau^{3/2}$.
> (4) However, an important source of error has not been accounted for, and this may be the reason that the experimental value derived below is inconsistent with the theoretical value, $\tau^{3/2}$.
> (5) In their calculation, Henry and Mills were not careful to take these limits in the proper order, and thus the value they obtained is incorrect.
> (5) In their calculation, Henry and Mills were not careful to take these

limits in the proper order, and /therefore/for this reason/as a result/, /as we see below/as shown in a previous work/, the value they obtained is incorrect.

(5*) In their calculation, Henry and Mills were not careful to take these limits in the proper order, and /as a result/for this reason/ the value they obtained is incorrect.

(6) This argument contains both unfounded assumptions and fundamentally flawed reasoning, and thus its conclusion is incorrect.

(6) This argument contains both unfounded assumptions and fundamentally flawed reasoning, and its result is an incorrect conclusion.

(7) This model is able to capture the extremely long memory effect. Hence the form of $\theta(\tau)$ it yields is much closer to that found experimentally.

(7) This model is able to capture the extremely long memory effect. For this reason the form of $\theta(\tau)$ it yields is much closer to that found experimentally.

(8) To this point, the renormalization of α has been ignored. Therefore the phase diagram in Fig. 2 differs significantly from that in Fig. 4, found experimentally.

(8) To this point, the renormalization of α has been ignored. /For this reason/This is the reason that/As a consequence/As a result/ the phase diagram in Fig. 2 differs significantly from that in Fig. 4, found experimentally.

I now discuss each of the above examples separately.

There seem to be three possibilities for the situation in which (2) is being used. The three interpretations of this sentence and the problem resulting in each case are discussed below.

The first possibility is that the inconsistency of the masses under consideration has previously been made evident to the reader and that the clause "the number of...small" is meant only to describe the reasonableness of this inconsistency. In this case, we have a problem of *type 1*.

The second possibility is that the clause "the number of...small" is meant to describe the reason responsible for the inconsistency and as such is regarded as the demonstration of the stated conclusion. As discussed in Section 1, *therefore* can be used in such a role, in which case it is usually synonymous with *for /this/that/ reason*. (In fact, it is used in precisely this way in examples (9) and (10) of Section 1.) With this interpretation, however, we encounter a more complicated type of problem. In order for this interpretation to make sense, the author would have to know that these two values do not agree and that the reason for this disagreement is that the number of data points is small. However, in order to know this, the author must also know that these two values would agree if the number of data points were sufficiently large. But this could not be the case unless such a large number of data points existed, in which case the sentence would serve no purpose. Disregarding such a situation, the problem here is seen to be of *type 2*. The pretext of this sentence appears to be that the amount of data is too small to guarantee a

reliable statistical representation. However, this does not imply that the quality of the statistical representation given by this data set is so poor as to be responsible for the discrepancy mentioned. In general, such a causation cannot be known with certainty, as we cannot determine precisely the error introduced by the fact that the data set is small. The situation here should be compared with that in (9) and (10) of the previous section. There, "therefore" is appropriate because, even though the situations stated as the results do not necessarily follow inevitably from the stated causes, it is known with certainty that in the presently considered cases these are indeed the causes. In other words, in those examples, even though their connection is not one of inevitability, both the cause and result are known with certainty. Contrastingly, in (2), although the result is certain, the cause is uncertain. The words *thus*, *therefore* and *hence* can never be used in such situations. In (2), (2^{*}) and (2^{**}) this problem does not exist.[6] To contrast with (2), note that the following is possible.

> (9) The number of data points is still quite small, and therefore the value we obtain for the mass has a large uncertainty.

In this case, the stated result is the uncertainty. Here, the fact that the number of data points is small can with certainty be deemed the cause of this result.[7]

The third possible situation with regard to (2) is that the statement "the number of data points is still quite small" is itself meant to be an argument from which we can conclude that the two values of the mass are inconsistent. However, this is obviously nonsense, because the scarcity of data alone implies nothing definite about the relation between the masses.

It appears that in (3), the author intended for the clause "an important source...for" to be an explanation of the reason that these two values are inconsistent. This can be understood from the fact that their inconsistency is already evident to the reader, through direct comparison of the two values given. In other words, the conclusion that these values differ is not obtained from the *[reason] + therefore + [conclusion]* construction itself. Thus, assuming that the use of "therefore" here is correct, the only possible meaning this sentence could express is that the fact that an important source of error has been ignored allows us to judge the values $\tau^{0.9\pm0.2}$ and $\tau^{3/2}$ to be different. This is absurd. The apparent intended meaning is expressed by (3).

It is instructive to compare (4) with (3). If we assume that the use of "therefore" here is correct, this sentence asserts that from the fact that this source of error has been ignored, we can conclude that the quantities in question are inconsistent. This, obviously, is not true. Thus we are led to believe that either the assertion here is not meant as a demonstration of the causal connection resulting in the inconsistency or it is meant to be the demonstration of an uncertain such connection. Hence, we have a problem of either *type 1* or *type 2*.

For (5), there are two possibilities, one in which the fact this "value" is incorrect has already been demonstrated and one in which it has not. In the first case, this

[6]Note that the statement in (2^{**}) that "we attribute..." (unlike the original) does not rule out the possibility that we might be incorrect in so attributing.

[7]Both *thus* and *hence* would express a somewhat inappropriately direct connection in (9).

would be another example of a *type 1* problem, so let us ignore this possibility. In the second case, there are two feasible interpretations, as discussed below.

The first interpretation is that this sentence takes the logical form *[reason] + thus + [conclusion]*. However, if this were the case, there would be two problems. First, *therefore* (expressing the meaning of *for this reason*), not "thus," would be the correct choice. Second, if we only changed "thus" to *therefore*, the first clause could be misinterpreted as an argument rather than the elucidation of a reason. To avoid this problem, something like "as shown in a previous work," "as is easily shown," or "as we see below" should be added, as in (5).

The second possible interpretation is that (5) expresses the following meaning: As a general rule, carelessness in taking the order of limits necessarily results in the derivation of incorrect values, and therefore, because Henry and Mills were careless, the value they obtained is incorrect. There are two problems with this. First, obviously this kind of carelessness does not necessarily result in an incorrect result, and second, the first clause of this sentence is erroneously presented as a statement of the basis for concluding that the value obtained by Henry and Mills is incorrect. The first problem could be solved by changing "thus" to, for example, *therefore*, which lacks the implication of inevitability. However, this would not solve the second problem. With *therefore*, this sentence would no longer have an implication of generality or inevitability, but it would still assert that in the present case, Henry and Mills' carelessness provides the grounds to judge their result as incorrect. Clearly this is not true, because it is entirely possible that they got 'lucky'. With "as a result," by contrast, both problems are avoided. The meaning correctly expressed by (5*) is that there are pre-existing grounds on which the value obtained by Henry and Mills has already been judged incorrect and that here we are merely citing their carelessness as the source of their mistake. It is instructive to compare (5) with the following.

> (10) In their calculation, Henry and Mills took these limits in the wrong order, and thus the value they obtained is incorrect.

It is implied by this sentence that we know that if these limits are taken in the wrong order then the result will necessarily be wrong. Thus, here, the direct logical causation expressed by "thus" is appropriate.[8] In this case, the clause "in their calculation...order" does indeed provide the evidence from which the incorrectness of the value in question can be judged. Now, compare (5) with the example below.

> (11) In their calculation, Henry and Mills were not careful to take these limits in the proper order, and thus their result cannot be trusted.

As in (10), the first clause here constitutes a statement from which the conclusion introduced by "thus" can be drawn. This sentence would be appropriate in three different cases: (i) it is known that the order of the limits is important, but it is not known if Henry and Mills took them in the proper order; (ii) it is not known if the order of the limits is important, and if the order is important, it is not known if Henry and Mills took them in the proper order; (iii) it is not known if the order

[8] Replacing "thus" with either *hence* or *therefore* would leave the meaning essentially unchanged.

of the limits is important, but if the order is important, it is known that Henry and Mills did not take them in the proper order.[9]

Assuming that (6) has neither a *type 1* nor *type 2* problem, we are left with one possible interpretation. With this interpretation, this sentence incorrectly implies that a true conclusion cannot result from invalid assumptions and/or flawed reasoning. It asserts that, based on the fact that the assumptions are unfounded and the reasoning is flawed, it is certain that the conclusion is incorrect. Contrastingly, (6) merely identifies the source of the incorrectness of the conclusion without identifying the basis on which it has been judged incorrect. It is useful to compare (6) with the examples below.

> (12) This argument contains both unfounded assumptions and fundamentally flawed reasoning, and thus we cannot regard the conclusion as meaningful.
> (13) This argument contains both unfounded assumptions and fundamentally flawed reasoning and thus has resulted in an incorrect conclusion.

These sentences do not have the logical problem of (6). As expressed by (12), the existence of unfounded assumptions and flawed reasoning in an argument does indeed provide the basis to judge the conclusion to which it leads as meaningless (which is different from being *incorrect*). Like (6), (13) does not identify the basis on which this conclusion has been deemed incorrect, but, rather, it merely identifies the problems that have led to such a conclusion. It is implied here that this conclusion has already been proven incorrect, and, with this knowledge, the author has studied the argument in question and found that the problems cited are the cause. It is important to understand here that, in terms of the *[premise/cause/reason] + thus + [conclusion/result]* structure, the *[conclusion/result]* is *not* that the conclusion considered here is incorrect but that this conclusion (which is already known to be incorrect) has resulted from a faulty argument.[10] Note that the meanings of "thus" in these two sentences differ. In (12) it is synonymous with *as a result* or *consequently*, and in (13) it is synonymous with *in this way*.[11]

The meaning expressed by (7) is that given the ability of this model to capture the long memory effect, it follows logically that it will give results closer (than the results of some previous model) to those found experimentally. It is difficult to imagine a situation in which this assertion would not be too strong. The rewritten version simply identifies this feature of the present model as being responsible for its ability to produce such results, without asserting that such results follow necessarily.

In the situation described in (8), the fact that α is not renormalized would seem to be sufficient as a certain cause of the stated disagreement, and therefore this sentence does not have a *type 2* problem. It appears that the author intended for the first sentence to be an explanation of the reason underlying the conclusion that

[9] In (11), "thus" could be replaced by either *therefore* or *hence* with almost no change of meaning.

[10] To understand this point, it is important to note that the subject of the clause "thus has resulted in an incorrect conclusion" is the implied "this argument."

[11] Both *therefore* and *hence* could be used in place of "thus" in (12) and (13), although the nuances would change somewhat.

is demonstrated by Figs. 2 and 4 – that the phase diagrams differ significantly. This leads us to conclude that there is a *type 1* problem here. If, on the other hand, we assume that the use of "therefore" is correct, then we must interpret the first sentence as providing grounds to judge that the figures under consideration differ. In other words, the situation here would evidently be one in which it cannot be determined that these figures differ by simply comparing them. While such a situation is possible,[12] it is probably not what the author intended. It is more likely that the intended meaning is conveyed by the various versions of (8). The meaning clearly expressed by this sentence is that the unrenormalized condition of α causes the phase diagrams to differ and that their difference can be seen by directly comparing the figures. (As this example illustrates, although *therefore* is very often synonymous with *for this reason*, there are differences.)

Now, compare (8) with the following.

> (14) To this point, the renormalization of α has been ignored. Therefore the phase diagram in Fig. 2 should not be considered an accurate expression of the predictions of the model.

In contrast with (8), whose import is that because α is not renormalized we can conclude that Fig. 2 differs from Fig. 4, the logical assertion of (14) is that because α is not renormalized, we can conclude that Fig. 2 should not be considered as accurately representing the predictions of the model. Given that the renormalization of α is important to extract the physical description afforded by the model, this is obviously a sound line of reasoning.[13]

123.2.2 Problem of grammar

The example below illustrates a common type of grammatical mistake.

> (15) These quantities are both negative, /thus/therefore/hence/ their product is positive.
> (15) These quantities are both negative, and /thus/therefore/hence/ their product is positive.
> (15*) These quantities are both negative. /Thus/Therefore/Hence/ their product is positive.

Because *thus*, *therefore* and *hence* are adverbs, they cannot be used to join two independent clauses, as in (15). In (15) and (15*), the simplest ways to resolve this problem, namely, inserting a conjunction and forming two sentences, are demonstrated.

[12] For example, the information that α has not been renormalized could allow us to interpret Fig. 2 in a particular way, and using this interpretation we may find that the behavior represented by this figure is inconsistent with that represented by Fig. 4.

[13] In (14), *thus* would be as natural as "therefore," but *hence* would be somewhat unnatural.

Chapter 124

too

In this chapter, I treat a common mistake of word order involving the adverb *too*.

124.1 Correct word order

The construction *too + [adjective]* is often used to modify nouns. Regarding word order, there are two cases to consider with this construction. First, when it is used to modify a singular noun that takes an indefinite article (*a* or *an*), this construction cannot appear between the article and the noun. Second, when it modifies a singular noun that takes the definite article (*the*), or a plural noun, this construction cannot appear before the noun. The following demonstrate correct word order.

> (1) We obtain too large a value for the present application.
> *([adverb] [adjective] [article] [noun])*
> (1*) We obtain a value too large for the present application.
> *([article] [noun] [adverb] [adjective])*
> (2) We obtain values too large for the present application.
> *([noun] [adverb] [adjective])*
> (3) The appearance of the value too large to be accounted for by the present theory is interesting.
> *([article] [noun] [adverb] [adjective])*

The important point to be noted here is that the use of *too* changes the normal orders *[article] [adverb] [adjective] [noun]* (for example, */a/the/ very red apple*) and *[adverb] [adjective] [plural noun]* (for example, *very red apples*) to those indicated above. (Note that if we wished to write a sentence like (2) without the prepositional phrase "for...application," it would be best to write it as follows: *We obtain values that are too large.*[1])

124.2 Incorrect word order

The following are typical examples of mistaken word order involving the use of *too*.

[1] The sentence *We obtain values too large* is grammatically correct, but its style is not suited to scientific writing.

(1) This theory predicts a too large amplitude.
(1) This theory predicts too large an amplitude.
(1*) This theory predicts an amplitude that is too large.
(1**) The amplitude predicted by this theory is too large.
(2) Our incorrect result is caused by the too small non-diagonal elements.
(2) Our incorrect result is caused by the fact that the non-diagonal elements are too small.
(3) One problem is the too small interaction term.
(3) One problem is the fact that the interaction term is too small.
(4) This produces too light Higgs bosons.
(4) This produces Higgs bosons that are too light.
(5) This approach gives too small values of ξ to account for all the data.
(5) This approach gives values of ξ that are too small to account for all the data.
(5*) This approach gives values of ξ too small to account for all the data.
(6) The cold dark matter model with pure adiabatic density fluctuations and $\Omega_0 = 1$ predicts too large amplitude of $P(k)$.
(6) The cold dark matter model with pure adiabatic density fluctuations and $\Omega_0 = 1$ predicts too large an amplitude of $P(k)$.

Note that final example is different from the others, as the article is simply missing in the original. It should be noted that, in general, the rules regarding the use of articles are not changed by the presence of *too*.

Chapter 125

traditional

The adjective *traditional* generally regards matters of culture, and therefore it is usually inappropriate in scientific and mathematical discussion. Those words in place of which I find it most commonly misused are *conventional*, *ordinary*, *usual*, *established*, *orthodox*, *familiar*, *regular*, *normal*, *standard*, *customary*, *existing*, *past*, and *previous*. Below I consider several representative examples.[1]

> (1) This is only true for traditional replicator equations.
> (2) This state corresponds to the OR mixed state in traditional binary models.
> (3) The traditional approach relies on the operator product expansion.
> (4) The intermediate range attraction in the NN interaction has been traditionally described by the σ-exchange in the meson exchange picture.
> (5) In traditional experiments on mud cracks, such behavior was not observed.
> (6) Quantization has traditionally been carried out in this manner.
> (7) But this is true even in the context of traditional non-linear sciences.

In these sentences, "traditional" ("traditionally") could be replaced by the following: in (1), *conventional*, *ordinary*, *established*, *familiar*, *standard*; in (2), *conventional*, *ordinary*, *established*, *familiar*, *standard*; in (3), *conventional*, *ordinary*, *usual*, *established*, *familiar*, *standard*, *customary*, *existing*; in (4), *conventionally*, *ordinarily*, *normally*, *usually*, *customarily*, *previously*; in (5), *previous*, *conventional*; in (6), *conventionally*, *ordinarily*, *usually*, *customarily*, *previously*; in (7), *established*, *familiar*, *existing*.

[1] It appears that the misuses of *traditional* illustrated here result from the misconception that it corresponds to 慣例の. In fact, in most situations, it is not appropriate to translate 慣例の as *traditional*.

Chapter 126

units

126.1 Introduction

Physical quantities are usually expressed in terms of units of measure, most commonly the SI fundamental units, meters (m), kilograms (kg), seconds (s), amperes (amp), degrees Kelvin (K), moles (mol) and candelas (cd). The combination of fundamental units in terms of which a quantity is expressed is referred to as the 'units' of this quantity. (For example, the units of the quantities 4 m, 10 s^{-1}, and 0.3 kg-s/mol are m, s^{-1} and kg-s/mol.) There are several problems I find with use of the word *unit(s)*. I treat the most serious of those in this chapter.

In Sections 2–4 I discuss the use and misuse of *unit(s)*, and in Section 5 I give examples.

126.2 *unit(s)* vs. *dimension(s)*

Often I find the terms *unit(s)* and *dimension(s)* confused. It is important to keep their distinction clear: Dimensions are measurable attributes characterizing physical entities and phenomena, while units are the standards of measure employed for their quantitative expression.[1] The so-called fundamental dimensions (基本量) corresponding to the fundamental units listed above are the following: length, mass, time, electric current, temperature, quantity of elementary entities, and luminous intensity. In analogy to the case of *units*, the combination of fundamental dimensions characterizing a given quantity is referred to as the 'dimensions'（次元）of this quantity. The most common mistake involving the use of *unit(s)* and *dimension(s)* is that in which *units* is erroneously used for *dimensions* in this sense.[2]

[1] Of course, both of these words have several other meanings, but we do not consider them here.

[2] Perhaps some of the confusion regarding the use of *unit(s)* and *dimension(s)* results from the fact that the correspondence between some of the English and Japanese terms discussed in this section is not simple. Even if we consider only use in physics and mathematics, there is no single word in Japanese that corresponds to *dimension*. As seen above, in some cases it corresponds to 量 and in some cases to 次元. Also, it can be used with the meaning of 寸法. Similarly, 量, as used in physics and mathematics, in some cases is translated as *dimension* and in some cases as *quantity*. In this context, the basic difference between *dimension* and *quantity* is that the former expresses an abstract meaning, while the latter expresses a concrete meaning. More precisely, a quantity is a

126.3 Singular form

In the presently considered usage, the singular form *unit* is appropriate only in certain limited situations. Use of the plural form is much more common.

126.3.1 When the singular form is inappropriate

There are two important points in regard to the inappropriate use of *unit*. These are discussed below.

First, suppose we are considering some length, l. To say that l is expressed in units of meters means that one meter of length is regarded as one unit. In other words, with respect to l, we are using *unit* and *meter* to mean the same thing. Thus, for the same reason that we would generally use the plural *meters* in expressions concerning l, we also use the plural *units*.

The second point can be understood by considering the following.

> (1) We use units in which $G = 1$ and $c = 1$.

If we were to use *unit* in such an expression (perhaps something like *we use a unit for which...*), the implication would be that in our analysis, there is only one unit of measure. In other words, it would seem that every quantity we consider has the same dimensions and that the corresponding unique combination of fundamental units is the "unit" that we use. This is a very unlikely situation.

126.3.2 When the singular form is appropriate

Although somewhat rare, there are situations in which the singular form *unit* can be used. One of these is demonstrated by the following.

> (2) We adopt the effective Bohr radius a_B^* as the unit of length and the effective Rydberg energy E_{Ry}^* as the unit of energy.

The reason that "unit" is appropriate here is that it is being used in an abstract sense.

It should be noted that it is possible to use the abstract *unit* in situations that *units* is usually used. For example, the expression *l is expressed in units of meters* could be rewritten as *l is expressed in the unit of the meter*. However, this is quite awkward and unnatural. (Conversely, a rewritten form of (2) with proper use of *units* would also be very unnatural.)

126.4 Misuse in reference to equations

I often find expressions like that below.

> (1) We use the units $G = 1$, $c = 1$ and $\hbar = 1$.

concrete realization (for example, 2 kg) of a dimension or combination of dimensions (for example, mass).

This sentence does not make sense. The problem here is that the expressions "$G = 1$," "$c = 1$" and "$\hbar = 1$" themselves are not "units," as the sentence asserts. The correct expression here is the following.

(1) We use the units in which $G = 1$, $c = 1$ and $\hbar = 1$.

There are two additional, somewhat technical points related to the expression in (1) that should be made here. The first regards expressions like that below.

(2) We use units in which $G = c = \hbar = 1$.

The problem here is that, although in the units considered, the numerical values of the quantities G, c and $\hbar$ are the same, these quantities have different dimensions, and therefore equating them is very strange on physical grounds. Indeed, strictly interpreted, such expressions are simply wrong. The second point is demonstrated by the following.

(3) We use the units in which $G = 1$ and $c = 1$.
(3) We use units in which $G = 1$ and $c = 1$.

The problem with (3) regards the use of "the." This use implies that there is one unique set of units specified by the relations $G = 1$ and $c = 1$. However, this is not true. Because G and c together involve three dimensions, length, time and mass, the units in which they are expressed cannot be uniquely determined by two equations. Note, however, that (1) does not have this problem.

126.5 Examples of misuse

Below I present examples illustrating a number of problems I find with the use of *units*.

(1) This quantity has unit of length.
(1) This quantity is expressed in units of meters.
(1*) This quantity has the dimension of length.
(2) This quantity has the unit of energy.
(2) This quantity is written in units of kg-m^2/s^2.
(2*) This quantity has dimensions of energy.
(3) γ is in unit of s^{-1}.
(3) γ is in units of s^{-1}.
(4) In this unit we have $\sigma = 1/2$.
(4) /With/In/ these units we have $\sigma = 1/2$.
(5) Here the quadrupole moment is plotted in fm^2 units.
(5) Here the quadrupole moment is plotted in units of fm^2.
(6) This is to be rescaled in unit of $|\lambda|$.
(6) This is to be rescaled in units of $|\lambda|$.
(7) The unit of D is $\sigma^2\omega_0$.
(7) D is in units of $\sigma^2\omega_0$.
(7*) The quantity $\sigma^2\omega_0$ is considered one unit of D.

(8) Hereafter we adopt the unit of $k_{\mathrm{B}} = 1$.
(8) Hereafter we adopt units in which $k_{\mathrm{B}} = 1$.
(9) We use the natural unit in which $\hbar = 1$.
(9) We use natural units in which $\hbar = 1$.
(10) The CS flux is quantized in unit of 2π.
(10) The CS flux is quantized in units of 2π.
(10*) The value 2π is considered one unit of CS flux.

I would like to draw attention to two points here. First, in (1), (2), (3) and (7), if we used *has* in place of "is expressed in," "is written in" and "is in," the implication would be that the particular units of meters, kg-m^2/s^2, s^{-1} and $\sigma^2\omega_0$ are intrinsic to the quantities in question. Of course this is not true. (For example, instead of meters, we could use feet, 3.3 inches, the radius of Jupiter, etc.) Second, note the use of the singular "unit" in (7*) and (10*). Some of the other sentences here could also be rewritten in ways that the singular form would be appropriate, but these are all somewhat unnatural. For example, (8) could be written as follows: *$\hbar$ is considered one unit of angular momentum.*

Chapter 127

until now, *up to now*, *to now* and related expressions

127.1 Introduction

The phrases *until now*, *up to now* and *to now* express the meaning that some activity, condition, etc., has continued from some time in the past to the present. There is also, to varying degrees, the implication that this activity or condition terminates now. In the case of *until now*, this meaning of termination is strong and clear. It is somewhat weaker for *up to now*, while it is very weak (and in many cases non-existent) for *to now*. There are several other commonly used expressions that share the basic meaning of the continuation of some state up to (and, to varying degrees of clarity, ending at) the present time. These include *until this time*, *until the present*, *up to the present (time)*, *to now*, *to this time* and *to the present (time)*. Among these phrases, as a general rule, the meaning of termination is expressed strongly by those containing *until*, somewhat less strongly by those containing *up*, and weakly by those containing neither.

Expressions of this type are almost always misused in the papers I proofread.[1] There are three main types of misuse that I encounter. These are treated separately in the following sections.

127.2 Problems with verb tense

127.2.1 Misused with present tense verbs

Although there are some exceptions, usually expressions like *until now*, *up to now* and *to now* cannot be used with present tense verbs. The reason for this is clear: Such expressions necessarily are used in reference to past conditions. When they are used with present tense verbs, in addition to this simple problem of mismatched meaning,

[1]Apparently, these expressions are usually used by Japanese authors as translations of 今まで. While such translations are not necessarily incorrect, there are some subtle points involved with the use of expressions like *until now*. For this reason, without considering the context, directly translating 今まで as one of these expressions can lead to problems.

there is usually a problem of ambiguity. The following examples demonstrate this point.

> (1) Up to now, there are two verification methods for the solutions of nonlinear elliptic equations.
> (1) There are two verification methods for the solutions of nonlinear elliptic equations.
> (1*) To this time there had been two verification methods for the solutions of nonlinear elliptic equations.
> (2) Until now, very little is known about the behavior of well-developed cracks.
> (2) Very little is known about the behavior of well-developed cracks.
> (2*) Until /now/recently/, little /had been/was/ known about the behavior of well-developed cracks.
> (3) To now the breaking of the BRST invariance is not considered.
> (3) To this point, we have not considered the breaking of the BRST invariance.

The intended meaning of (1) is quite unclear, because the connotations of the prepositional phrase "up to now" and the main clause, "there are...," are incompatible. The phrase "up to now" seems to imply that the statement which follows describes a situation that no longer exists. The use of the present tense verb "are," however, clearly contradicts this. The apparent possible interpretations of this sentence are expressed by (1) and (1*). The first of these asserts that the situation in which there are two "verification methods" still exists. The second asserts that this situation has changed, and its implication is evidently that a new verification method is introduced in the present work (or, perhaps, some recent work that is being discussed). The second example is similar. The third example is somewhat different. Here it seems that the only possible interpretation is that expressed by (3). The suggestion of this sentence is that the breaking of this invariance will be considered after this point (that is, it still has not been considered). For this reason, the present perfect tense ("have not considered"), rather than the past perfect tense, is appropriate.

127.2.2 Misused with present perfect tense verbs

As demonstrated by (3) above, there are situations in which expressions like *up to now* can be used with present perfect tense verbs. Often, however, this is not possible. The examples below illustrate this point.

> (4) Up to now, this point has not been raised.
> (4) This point has not previously been raised.
> (4*) /To/Until/ this time, this point had not been raised.
> (5) Until now this problem has not been seriously considered.
> (5) This problem has not been seriously considered.
> (5*) This problem had not been seriously considered until this time.
> (6) Up to now these calculations have been made only in the $d = 2$ case.
> (6) These calculations have been made only in the $d = 2$ case.

(6*) To this time, these calculations /have/had/ been made only in the $d = 2$ case.
(6**) To this point, these calculations have been made only in the $d = 2$ case.

The problems with each of the original sentences here are similar: While the use of the introductory prepositional phrase together with the present perfect verb tense implies that the action mentioned in the main clause has not yet been carried out, from the content of the main clause, it can be concluded that in fact this is not true. For example, in (4), the use of "up to now" with "has not been raised" yields the meaning that "this point" still has not been raised. However, if this were the case, the reader would not know what "this point" is, and this sentence would be meaningless. In (5), the phrase "until now" makes it seem that now (that is, in the present paper) the problem is considered seriously, but the present perfect tense verb "has not been" would lead one to believe that the situation in which this problem is not considered seriously continues even now. Thus the author's intention is quite unclear. The last example is similar.

I now compare the meanings expressed by the rewritten versions for each example. Note that (4) and (4*) convey almost identical meanings. They both imply that "this point" is raised *at the present time* (that is, in the present paper). There are two points to note with regard to these sentences. First, if "has" in (4) were changed to *had*, the implication of this sentence would be that "this point" was raised at some time in the past. Second, in (4*), "to" and "until" are nearly identical in meaning. The meaning of (5) is that "this problem" still has not been considered seriously (although it may be considered seriously at some later point in the present paper), while the meaning of (5*) is that it has now (either in this paper or in some other recent work) been considered seriously. The connotations of (6) and (6*) are somewhat different. In (6*), it is clear that the calculations in question are made in some case other than $d = 2$ in the present paper. Obviously, (6) has no such implication. Note that in (6*), we could use either "have been made" or "had been made," depending on where in the paper this sentence appears. If it appears before the calculations in question, the former is better, but if it appears after, the latter is better. Example (6**) represents a different interpretation of the original, which we now consider.

In (6) and (6*), the verb tenses (present perfect and past perfect) reflect true time-like meanings with regard to the situation in the real world; that is, (6) implies that nobody has ever done calculations other than in the $d = 2$ case, and (6*) implies that until the time that the calculations presented in the this paper were carried out, nobody had done such calculations. These are the most natural interpretations of (6), because "up to now" appearing there seems to have a real time-like meaning. The situation is similar in (4) and (5). It is for this reason that the introductory prepositional phrases do not match the present perfect verb tense in these sentences: These phrases imply that the situations in question no longer exist, while the present perfect verb forms imply that they continue to exist. Now, let us examine (6**). This is also a possible (albeit unlikely) interpretation of the original. In this case, the context of the sentence is the content of the present paper, and for this reason, the

present perfect verb tense does not have a real time-like meaning. Rather, its use imparts the meaning that the situation described by this sentence exists up to the present point of the paper. This meaning indeed matches that of the introductory prepositional phrase, "to this point," which clearly refers to a point in the paper, not the real-world present time. This also explains the use of the present perfect tense in (3).

127.3 Problems of meaning

127.3.1 Misused in place of *yet*

The expressions considered in this chapter cannot be used in place of *yet*. Indeed, there is an important difference in meaning here, as *until now*, *up to now*, etc., imply that the state or condition under consideration has ceased to exist, while *yet* implies that it continues to exist. Consider the following.

> (1) Although we have not obtained a complete understanding of the relaxation until now, we have been able to determine τ in several simple situations.
> (1) Although we have not yet obtained a complete understanding of the relaxation, we have been able to determine τ in several simple situations.
> (2) Until now, however, there are no experimental data concerning activity patterns in the case of intermediate concentration.
> (2) However, there are yet no experimental data concerning activity patterns in the case of intermediate concentration.
> (3) Up to now there is no model that can trace cosmological evolution to present day conditions.
> (3) There does not yet exist a model that can trace cosmological evolution to present day conditions.
> (4) There is no conclusive experimental evidence of quark confinement until now.
> (4) There is yet no conclusive experimental evidence of quark confinement.
> (5) Although several methods have been proposed, none has been shown until now to be able to resolve this problem.
> (5) Although several methods have been proposed, none has yet been shown to be capable of resolving this problem.

In (1), use of "until now" leads the reader to believe that we now do have such a complete understanding. However, from the main clause, it is clear that this is not true. The use of the present tense verb in (2) seems to indicate that the intended meaning of "until now" is *yet*. The remaining examples are similar.

Note that in some of the above examples, *to now*, *to this time*, etc., could be substituted for "until now" or "up to now" to correctly express the meaning of *yet*. Specifically, their use would be quite natural in (2)–(4), but unnatural in (1) and (5). This demonstrates the point made in Section 1 that the meaning of termination is weak in those expressions that contain neither *until* nor *up*. However, even in

(2)–(4), these expressions would result in some degree of ambiguity, and for this reason, the rewritten versions above are preferable.

127.3.2 Misused in place of *already*

The following sentence illustrates a very common type of mistake.

> (6) As shown /up to now/until now/to now/ [7], this effect can be ignored.
> (6) As already shown [7], this effect can be ignored.
> (6*) As shown in Ref. [7], this effect can be ignored.

Without the citation, the most direct interpretation of the original here would be that this "showing" has continued from some previous point of the current paper up to the present point, where it ends. If this were the case, it would be best expressed by changing "/up to now/until now/to now/" to *above* or "as shown /up to now/until now/to now/" to *as we have just shown*. From the presence of the citation, however, it is clear that the meaning intended by the author is that expressed by (6) or (6*). These are nearly identical in meaning, but the use of "already" in the former gives the special emphasis that the fact that "this effect can be ignored" was shown at some previous time is in some sense unexpected (to the reader) or otherwise noteworthy.[2] If no such special emphasis is intended, (6*) is more appropriate.

127.3.3 Misused in place of *previously* or *above*

> (7) As mentioned /up to now/until now/to now/, we have not succeeded in doing so.
> (7) As mentioned above, we have not succeeded in doing so.
> (8) The first two of these solutions have been found /up to now/until now/to now/ [2].
> (8) The first two of these solutions were found previously [2].

In the first example here, the intention is to refer to something done previously in the present paper. The use of "up to now/until now/to now" imparts the meaning that this took place over an extended portion of the paper that reaches to the present point. However, because the act expressed by the verb "mentioned" is not something that takes place over an extended time, the meaning expressed by this sentence is problematic. In (8), the intention is to refer to something (i.e., finding solutions) done previously, and again this sentence expresses the idea that this act has taken place over an extended time up to the present. In this case, because finding a solution generally is something that does take place over an extended time, the type of problem in (7) does not exist here. However, because this did not take place up to the present (as is clear from the citation), this sentence is also problematic.

[2]See Chapter 10 for detailed discussion of this topic.

127.3.4 Misused with a non-time-like meaning

For clarity, it is usually best to use expressions like *up to now*, *to this time*, etc., which have explicit time-like meanings, only in reference to actual times. For example, it is best to avoid such phrases in reference to some part of a paper. We have seen some such examples above. Here I give two more.[3]

> (9) Until now, we have focused on only the attractive behavior.
> (9) To this point, we have focused on only the attractive behavior.
> (9*) In previous works, we focused on only the attractive behavior.
> (10) Unlike the model we consider in the present section, the one-dimensional models we have considered until now can be treated without complicated symmetry arguments.
> (10) Unlike the model we consider in the present section, the one-dimensional models we have considered in previous sections can be treated without complicated symmetry arguments.

The first example here demonstrates the ambiguity problem that can arise when expressions with explicit time-like meanings are used in reference to something other than a time. Here, judging from the content of the sentence as a whole, it appears that this statement is meant to be in regard to the investigation made in the present paper, as unambiguously expressed by (9). However, because of the use of "until now" in (9), its most direct interpretation is that expressed by (9*).

127.4 Superfluous use

I often find expressions like *up to now* used when nothing is needed. The following are typical.

> (1) Up to now, significant efforts have been devoted to understanding this behavior.
> (1) Great effort has been devoted to understanding this behavior.
> (2) However, all of these models have been thoroughly investigated until now.
> (2) However, all of these models have been thoroughly investigated.
> (3) In this paper, we extend this analysis to all existing baryons known until now in the flavor SU(3) sector.
> (3) In this paper, we extend this analysis to all known baryons in the flavor SU(3) sector.
> (4) This result has been obtained up to now.
> (4) This result was obtained previously.

In each of the examples above, it is clear without the expressions "up to now," etc., that the statement regards some activity carried out or some state existing in the past. In each case, this expression adds no meaning.

[3]In these examples, the meaning that the authors intended to express with "until now" is apparently that of これまで. Such usage should be avoided.

127.5 Comparison of *until now* and *up to now* with *to now*

As discussed in Section 1, there is an important difference between expressions like *up to now* and *until now* and those like *to now* and *to this time*, which contain neither *up* nor *until*. This is demonstrated by the following.

> (1) This is the most reasonable conclusion to draw from the evidence collected until now.
> (1) From the evidence collected until recently, this had been the most reasonable conclusion.
> (1*) This is the most reasonable conclusion to draw from the evidence collected /to now/to this time/.
> (1**) This is the most reasonable conclusion to draw from existing evidence.

Because the expression "until now" clearly expresses the meaning that the situation or state under consideration ends now, the original here relates the idea that the conclusion in question is no longer the most reasonable. More precisely, its use seems to imply that until recently, it had been the case that existing evidence supported this conclusion as the most reasonable, but now, evidently because evidence inconsistent with this conclusion has been obtained, this is not the case. However, because this interpretation is inconsistent with the use of the present tense verb "is," whether this is actually the intended meaning is somewhat unclear. Such a meaning is unambiguously expressed by (1). The other possibility seems to be that "until now" is misused in the original and that the author did not wish to imply that this conclusion is no longer the most reasonable. In this case, (1*) clearly conveys the intended meaning. Because "to now" and "to this time" here do not imply termination, the meaning of this sentence is that the conclusion of interest is still the most reasonable. The same meaning is expressed by (1**).

Chapter 128

view and *viewpoint*

128.1 General misuse

The nouns *view* and *viewpoint* are very often used with inappropriate nouns, verbs and prepositions. The following are typical examples.[1]

(1) A similar view arises from x-ray studies.
(1) A similar /picture/understanding/ /arises from/is provided by/ x-ray studies.
(2) This is interesting from the viewpoint of many-body problems.
(2) This is interesting in the context of many-body problems.
(3) In this viewpoint, the issue of sign is not important.
(3) /From this viewpoint/In this context/For this purpose/, the issue of sign is not important.
(4) We pursue this viewpoint.
(4) We take this viewpoint.
(4*) We pursue this line of reasoning.
(5) In our view this term is treated as a perturbation.
(5) /From our viewpoint/In our manner of thinking/In our approach/Within our framework/, this term is treated as a perturbation.
(6) Our arguments stand on this viewpoint.
(6) Our arguments are made from this viewpoint.
(6*) Our arguments are based on this /understanding/set of assumptions/philosophy/manner of thinking/.
(7) In this paper we stand on such a viewpoint.
(7) In this paper we /take such a viewpoint/stand on such an assumption/use such a framework/employ such a manner of thinking/.
(8) From the viewpoint of the amplitude F, this is easily understood.
(8) This is easily understood if we consider the amplitude F.
(9) From the viewpoint of the confinement of an exciton in nanocrystals, there are two extreme cases.

[1]A number of the misuses considered here apparently result from the direct translation of 立場を取る, 立場から, 立場からすると, 立場に立つ and 観点から. These expressions cannot be translated directly into English.

(9) There are two extreme cases /involving/of/ the confinement of an exciton in nanocrystals.
(10) However, such a situation is not realistic in the following viewpoints:
(10) However, such a situation is not realistic for the following reasons:

To understand the problems here, it is only necessary to realize that when used as in the above examples, the noun *viewpoint* represents, in an abstract sense, the position from which a person looks at a problem, matter or situation, and the noun *view* represents what is seen from that position. In the following, using this understanding, I treat each of these examples separately.

Example (1) expresses the meaning that x-ray studies provide a position from which we can "view." This seems to imply that x-ray studies represent some system of philosophy or beliefs that provides a way of regarding and construing physical phenomena. This point can be understood by comparing (1) with the following.

(11) A similar view of the natural world arises from the polytheistic religion of the ancient Greeks.

This sentence is quite natural, as religion can indeed be thought of as providing a belief system in terms of which the natural world can be construed. Now, compare (1) with (1). Because a picture or an understanding of a physical system, unlike a view, is likely to arise from a particular type of experimental study, (1) is quite natural.

As "many-body problems" themselves neither are nor possess a viewpoint, (2) is strange. Here, to clearly express the intended meaning, "context" is probably the best choice.

Because a position does not have an inside, "viewpoint" cannot be the object of the preposition "in," as in (3). In (3), "from" means *as seen from* or *as considered from*.

A position is not something that can be "pursued," and for this reason (4) is quite unnatural. The intended meaning of this sentence is somewhat unclear, but it is probably that expressed by either (4) or (4*).

The meaning of (5) seems to be *In our opinion...* However, this interpretation results in a very unusual assertion that clearly does not express the author's intention. In fact, the author wished to state that within the computational approach they use (and perhaps, more abstractly, within the manner of thinking that motivates this approach), the term in question is treated perturbatively. This is expressed by (5).

The intended meaning of (6) is unclear. It seems to be that expressed by either (6) or (6*).

Example (7) appears to be a direct translation of Japanese. The rewritten versions in (7) are much more natural.

The problem in (8) is similar to that in (2): It is difficult to think of an amplitude as possessing a viewpoint. The intended meaning here is in fact quite difficult to surmise. Probably the most natural interpretation is that expressed by (8).

The last two examples repeat some of the problems found in the first eight.

128.2 *viewpoint* vs. *point of view*

Although the expressions *viewpoint* and *point of view* are similar, they are not always interchangeable. The main meaning of *viewpoint* is *a position (real or abstract) from which something is viewed*, while it can also be used as a synonym of *perspective*, *opinion* and *mental attitude*. *Point of view* possesses all of these meanings and more. Most important among these are the meanings of *manner of viewing* and *manner of thinking*, which are not possessed by *viewpoint*. In the following, these are the meanings with which "viewpoint" is mistakenly used.

(1) The structure around the crack discontinuity is then discussed from the topological viewpoint.
(2) This is an important problem of physics from both academic and practical viewpoints.
(3) From the phenomenological viewpoint, this distinction is irrelevant.
(4) However, from the biological viewpoint, such behavior is unrealistic.

In each case here "viewpoint" should be changed to *point of view* (*points of view* in the second example). In general, if the *viewpoint*/*point of view* in question does *not* characterize a person, then *point of view* is more appropriate than *viewpoint*. To better understand this point, it is worthwhile comparing the above problematic uses of *viewpoint* with the following very natural uses.

(5) This seems unreasonable from a modern viewpoint.
(6) These questions have long been considered from a religious viewpoint.
(7) We should try to consider this issue from a European viewpoint.

In each of these sentences, the "viewpoint" in question indeed does characterize a person (in some sense representing a person's 'mental position'), because the adjectives "modern," "religious" and "European" describe a person or a person's state.[2] The adjectives modifying "viewpoint" in (1)–(4), by contrast, do not.

128.3 *view point*

The combination *view point* should never be used in place of *viewpoint*.

[2]Note that *point of view* could also be used in (5)–(7).

Chapter 129

well and *good*

The adverb *well* is used mainly in two ways: to modify verbs and to modify past participles.[1] There are two common types of problems involved with its use, one of incorrect word order and one of inappropriate meaning. The adjective *good* shares the second of these.

129.1 Word order with *well*

The problem of mistaken word order involving *well* appears in two forms.

129.1.1 Modifying active verbs

In almost all situations that *well* is used to modify an active verb, it must appear after the verb. I often find this order mistakenly reversed. The following are typical examples.

> (1) The complex scaling method is applied so that the Jost functions well converge into fixed values in the asymptotic region.
> (1) The complex scaling method is applied so that the Jost functions /converge/converge rapidly/ to fixed values in the asymptotic region.
> (2) The theory well describes the qualitative features of these states.
> (2) The qualitative features of these states are described well by the theory.
> (2*) The theory faithfully describes the qualitative features of these states.
> (3) This measured value well agrees with that derived from Eq. (5).
> (3) This measured value is consistent with that derived from Eq. (5).
> (3*) This measured value has the same order of magnitude as the value derived from Eq. (5).
> (4) More data points are required to determine which value of d in our solution of Eq. (4.1) can well reproduce the observed $T_{\max}$.
> (4) More data points are required to determine the value of d in our solution of Eq. (4.1) that results in the best fit to the observed $T_{\max}$.

[1] A past participle is a past tense verb form that can act grammatically as an adjective.

(5) This operation well splits these energy levels.
(5) These energy levels become well separated by this operation.

In each of the original sentences above, there is a problem of word order. In addition, there are several other important points, as I now discuss.

Ignoring the content of the sentence, the easiest way to remedy the problem in (1) is to simply change "well converge" to *converge well.* However, mathematically, the meaning of *converge well* is unclear, because convergence is not something that can be characterized by degrees. A function, series, etc., either converges in some limit or it does not, and such convergence cannot be characterized as 'good'. Thus this use of "well" to modify "converge" is inappropriate.[2] It seems that the intended meaning is expressed by "converge" alone or, perhaps, "converge rapidly." Another problem with (1) is that we do not say that something converges "into" a value. Only "to" can be used here.

As with (1), we could remove the syntactical problem in (3) by simply reversing the order of "well" and "agree." However, from the scientific point of view, the resulting assertion is inappropriate. In general, a statement that experimental and theoretical results simply *agree well* is ambiguous, as it could be interpreted to mean that these results are consistent,[3] that, although not consistent, their discrepancy is in some sense small, that they are close according to some statistical characterization, that they are similar qualitatively, or that they are in some other way 'alike'.[4] The intended meaning of (3) seems to be that expressed by (3), but this is not entirely clear. The example below is even more ambiguous.

(6) The experimentally and theoretically obtained values agree well.
(6) Most of the experimentally and theoretically obtained values are consistent, although there are some discrepancies.
(6*) The experimentally and theoretically obtained values are all consistent.
(6**) All of the theoretical values lie within approximately 1.5 standard deviations of the corresponding experimental values.
(6***) The reduced χ^2 value of the fit of the theoretical values to the experimental values is approximately 0.7.
(6****) Each experimental value is of the same order of magnitude as the corresponding theoretical value.
(6*****) The experimentally and theoretically obtained values exhibit qualitatively similar behavior.

[2]Convergence can be characterized by several adjectives (including *absolute*, *strong*, *weak*, *uniform*, *simple*, *conditional*, *unconditional* and *rapid*), but *good* is not one of them.

[3]In science, in general, to say that two results are 'consistent' means that they are not mutually contradictory (in other words, from the premise that one is correct, it does not necessarily follow that the other is incorrect). In the case that these two results are two numerical values, their consistency implies that it is possible to attribute their difference to the uncertainty on one or both. In some cases, this uncertainty is of a statistical nature, and in such cases, the question of consistency becomes a probabilistic matter. (For related discussion and further examples, see Chapter 6.)

[4]See Chapter 6 for detailed discussion of the misuse of *agree.*

With the simplest interpretation of the original, it appears that the meaning expressed by either (6) or (6*) would be appropriate here. However, situations like those described by the other rewritten versions are also feasible.

The intended meaning of (4) seems to be that expressed by (4). Note that in addition to the problem of word order, there is a serious problem involving the use of "reproduce" here. In general, it is inappropriate to use *reproduce* in characterizing the relation between a theory and some experimental results, as only an experiment can reproduce the results of another experiment. Also, when used in this manner, *reproduce* has a problem of ambiguity similar to that of *agree well* discussed above. For these reasons, when describing the relation between theoretical and experimental results or between a model and a physical system, *reproduce* should be avoided in favor of such expressions as *predict*, *model*, *describe*, *approximate*, *account for* and *are consistent with*.

The grammatical problem with (5) could be solved by rewriting this as *This operation splits these energy levels well*.[5] However, the verb *separate* forms a more natural pair with *well* than does *split*. The reason is that in the present case, "well" is synonymous with *greatly* and describes an extent. It is more natural to characterize a separation (which connotes a distance) than a splitting (which simply connotes a state of division) in this way.

129.1.2 Modifying participles: adjectives and passive verbs

Well can appear before the participle it modifies. In this situation, these two words form a pair that modifies a noun. Although there are many expressions in which *well* is used in this way, it is more common for it to appear after the participle it modifies. Its position is usually determined by the meaning it is intended to express. While there is no general rule to specify the correct position in any given case, the following is a rough guideline. Usually, when *well* appears before the participle it modifies, it expresses a meaning of extent or degree, like *very*, *thoroughly*, *completely*, *fully*, *widely* or *totally*, and when it appears after the participle, it expresses a meaning of quality, like *effectively*, *properly*, *skillfully*, *efficiently* or *readily*.[6] Generally, when *well* appears before a participle, the participle acts as an adjective, and when it appears after a participle, the participle acts as a passive verb.

The most common mistake involved with the presently considered use of *well* is that in which it appears before the participle when it should appear after. This can be understood from the following.

> (7) The exact function is well fit by the numerically generated function, with the discrepancy less then 30% of the tolerance α everywhere.
> (7) The exact function is fit well by the numerically generated function, with the discrepancy less then 30% of the tolerance α everywhere.

[5] Note that we cannot simply exchange the positions of "well" and "splits," because in the resulting sentence, "well" would appear between the verb and its direct object, "energy levels." Such grammatical structure is not allowed.

[6] Notable among the exceptions to this guideline are expressions like *well-behaved*, *well-defined*, *well-formed* and *well-posed*, which act as single words (adjectives). However, these should be considered special cases, because, even among expressions of this hyphenated kind, those that conform to the above rule far outnumber those that violate it.

In (7), the position of "well" before the participle results in a connotation of degree or extent, and the resultant meaning is that this fit is somehow *thorough*. Obviously, this is not appropriate. Contrastingly, in (7), "well" expresses the desired meaning that the *quality* of this fit is good.

The examples below are representative of the problems resulting from the misplacement of *well* before the participle.

(8) The experimental value is well approximated by the theory.
(8) The experimental value is /closely/accurately/ approximated by the theory.
(8*) The experimental value is consistent with the prediction of the theory.
(8**) The discrepancy between the experimental value and the prediction of the theory is sufficiently small for the present purpose.
(8***) The prediction of the theory is only slightly outside the range of the experimental value.
(8****) The prediction of the theory is within one standard deviation of the peak, mean and median values of the experimental distribution.
(9) This behavior is well described by the critical vortex state models.
(9) The critical vortex state models are useful in the modeling of this behavior.
(9*) The critical vortex state models provide descriptions of this behavior that are sufficiently precise to be useful in many technical applications.
(9**) The critical vortex state models yield quantitative predictions for many aspects of this behavior that are consistent with present experimental results.
(9***) The critical vortex state models are as yet the most successful models in describing this behavior.
(9****) The qualitative nature of this behavior is faithfully modeled by the critical vortex state models.
(10) Galaxies in the early universe are well modeled by the so-called isothermal ellipsoid model.
(10) The so-called isothermal ellipsoid model has been found useful in the description of galaxies in the early universe.
(10*) The so-called isothermal ellipsoid model is capable of describing some important qualitative features of galaxies in the early universe.
(10**) The so-called isothermal ellipsoid model is to this time the most successful model for the description of galaxies in the early universe.
(10***) The so-called isothermal ellipsoid model gives predictions for several quantities regarding galaxies in the early universe that are /within the error bounds/consistent with/ their observed values.
(10****) The so-called isothermal ellipsoid model gives predictions for several quantities regarding galaxies in the early universe that are of the same orders of magnitude as their observed values.
(11) It is found that the experimentally observed M_{w} dependence of T_{g} can well be reproduced by the present theory.

(11) It is found that the experimentally observed M_{w} dependence of T_{g} /is accounted for by/is consistent with the predictions of/ the present theory.

(11*) It is found that the experimentally observed M_{w} dependence of T_{g} is fit well by the predictions of the present theory, with a reduced χ^2 value of .9.

(11**) It is found that the important qualitative features of the experimentally observed M_{w} dependence of T_{g} are described by the present theory.

(12) The master curve for each film can well be fitted by using the value $\delta = .013$.

(12) The master curve for each film is best fit if we use the value $\delta = .013$.

(13) This problem has been well studied.

(13) This is a well-studied problem.

(13*) This problem has been thoroughly studied.

The participle ("approximated," "described," "modeled," "reproduced," "fitted") appearing in each of (8)–(12) is more naturally characterized by a quality than by a degree or extent, and thus the simplest way to correct the original sentence is to place "well" after this participle. However, in each case, this change alone yields a sentence whose meaning is problematic from a scientific point of view, as illustrated by (8). The problem in (13) is somewhat different. Below I give additional discussion of some of these examples separately.

Although (8) sounds quite natural from the linguistic point of view, in fact it is vague. For this reason, something like one of the other rewritten versions is preferable.

There are two serious problems with (11). First, when used with the intended meaning, "well" cannot appear before the auxiliary verb (in this case "be").[7] Second, the expression "reproduced well" is problematic for the reasons discussed above with regard to (4).

In (13), "studied" was meant to act as the main part of the verb "has been studied," but the use of "well" here makes it appear that this is an adjective and that the verb is simply "has been." Of course, however, the resulting assertion is nonsensical. The mistake here seems to have resulted from a misconception concerning the adjective *well-studied*.

129.2 Inappropriate use of *well* and *good*

In the present section, we consider examples illustrating misuse of *well* and *good* in which they express inappropriate meaning.

[7] The following illustrates a situation in which *well* can appear before the auxiliary verb: *This result could very well be contradicted by future results.* Here "well" is synonymous with *likely*.

129.2.1 Scientifically meaningless use of *well* and *good*

The following sentences demonstrate misuses of *well* and *good* in which these words express essentially no meaning from a scientific point of view.[8]

> (1) These measured values agree well with those predicted by Eq. (7.7), and hence the observed temperature coefficient of the electric capacitance $\tilde{\alpha}$ can well be regarded as the linear thermal expansion coefficient.
> (1) These measured values are consistent with those predicted by Eq. (7.7), and hence the observed temperature coefficient of the electric capacitance $\tilde{\alpha}$ can be regarded as the linear thermal expansion coefficient.
> (1*) These measured values are consistent with those predicted by Eq. (7.7), and hence the observed temperature coefficient of the electric capacitance $\tilde{\alpha}$ can, with sufficient precision, be regarded as the linear thermal expansion coefficient.
> (1**) While there are some discrepancies, most of these measured values are consistent with those predicted by Eq. (7.7), and hence the observed temperature coefficient of the electric capacitance $\tilde{\alpha}$ can be regarded as approximately equal to the linear thermal expansion coefficient.
> (1***) Fitting the measured values with the values predicted by Eq. (7.7), we obtain a reduced χ^2 value of 1.3, and therefore the observed temperature coefficient of the electric capacitance $\tilde{\alpha}$ can be regarded as approximately equal to the linear thermal expansion coefficient.
> (1****) The qualitative features of this set of measured values are similar to those of the values predicted by Eq. (7.7), and hence, to the extent that we are interested in a qualitative description, the observed temperature coefficient of the electric capacitance $\tilde{\alpha}$ can be regarded as the linear thermal expansion coefficient.
> (2) These values are well predicted by the theory.
> (2) These values are consistent with those predicted by the theory.
> (2*) Each of these values has the same order of magnitude as the corresponding prediction of the theory.
> (2**) The theory yields well-defined predictions for these values.
> (3) The agreement between the predicted form of $\mu(t)$ and its experimental form is good.
> (3) The predicted and experimental forms of $\mu(t)$ are qualitatively quite similar.
> (3*) The predicted and experimental forms of $\mu(t)$ are qualitatively quite similar, although quantitatively there are inconsistencies.
> (3**) The predicted and experimental forms of $\mu(t)$ are identical within experimental uncertainty.
> (3***) The agreement between the predicted and experimental forms of $\mu(t)$ is better than that obtained with any previous theory.

[8] It should be noted that *well* and *good* are not the only words misused in the manner considered here. Indeed, in most of the examples presented here, replacing *well* and *good* with such words as *satisfactorily/satisfactory*, *acceptably/acceptable*, *fairly/fair*, *nicely/nice*, *not badly/not bad* or *reasonably/reasonable* would change the problem little.

(3****) The χ^2_ν value for the fit of the predicted form of $\mu(t)$ to the experimental form is 1.1.
(4) The obtained analytical results are found to be in good agreement with the numerical results.
(4) The obtained analytical results are found to exhibit the same important qualitative features as the numerical results.
(4*) The numerical results appear to converge to the analytical results as the precision of the numerical calculation is increased.
(4**) The analytical and numerical results are similar both qualitatively and quantitatively, although there is clearly some discrepancy that is not accounted for by truncation error.
(5) We conclude that this model gives a good explanation of polarization observables.
(5) We conclude that this model provides a description of polarization observables that accounts for their important qualitative behavior within the present context.
(5*) We conclude that the predictions provided by this model are consistent with all existing experimental data on polarization observables.
(5**) We conclude that the description provided by this model is capable of accounting for most experimental data on polarization observables.
(5***) We conclude that the description of polarization observables provided by this model is better than that provided by any previous model.
(5****) Considering its accuracy and simplicity, we conclude that this model provides a useful description of polarization observables.
(6) Agreement between the phenomenological optical potential and the microscopic optical potential is good.
(6) The phenomenological and microscopic optical potentials yield qualitatively similar behavior.
(6*) The descriptions provided by the phenomenological and microscopic optical potentials agree essentially equally well with current experimental data.
(6**) The precision of existing experimental data is not sufficient to distinguish the predictive abilities of the models employing phenomenological and microscopic optical potentials.
(7) The results show good agreement between λ_1 and the λ_1'.
(7) The results indicate that the predictions obtained using λ_1 and λ_1' are equally good.
(7*) The results indicate that the behavior of the model is essentially the same whether we use λ_1 or λ_1'.
(7**) The results indicate that, with regard to the behavior of interest, the model is essentially unchanged when λ_1 is replaced by λ_1'.
(7***) Present experimental data do not allow a judgment with regard to the relative merits of λ_1 and λ_1'.
(8) It is found that our theory makes a good prediction for the storage capacity.
(8) It is found that the predictions concerning the storage capacity pro-

vided by our model are consistent with experiment.
(8*) It is found that our model accounts for all important qualitative features of the storage capacity in the realm of interest.
(8**) It is found that the qualitative behavior of our model is similar to that found experimentally, although there are quantitative discrepancies.
(8***) It is found that, for systems of the type considered here, our model provides a better description of the storage capacity than any previous model.
(8****) It is found that the prediction for the storage capacity provided by our model is sufficient for /the present purpose/most current technical applications/.
(9) According to the good correspondence of Figs. 8 and 10, we can conclude that the $O(\alpha^2)$ approximation is quite adequate to describe the undulation of this type of membrane.
(9) From the small discrepancy between the graphs in Figs. 8 and 10, we can conclude that, for our present purposes, the $O(\alpha^2)$ approximation is adequate to describe the undulation of this type of membrane.
(10) We find that this version of the mixed fluctuation model gives a very good fit to the observational data.
(10) We find that this version of the mixed fluctuation model is consistent with the observational data.
(10*) We find that this version of the mixed fluctuation model is, for the most part, consistent with the observational data, although there are some discrepancies.
(10**) We find no statistically significant discrepancy between the predictions obtained from this version of the mixed fluctuation model and the observational data.
(10***) There are few statistically significant discrepancies between the predictions obtained from this version of the mixed fluctuation model and the observational data, while for the discrepancies that do exist, there is no clear trend suggesting the breakdown of the model's descriptive ability in the presently considered regime.
(11) With this input, the model gives good reproduction of the NN data.
(11) With this input, the predictions of the model are consistent with the NN data.
(11*) With this input, the reduced χ^2 values characterizing the fit of the model predictions to the NN data are all between 0.7 and 1.3.
(12) The standard model of elementary particles has had good agreement with experiments.
(12) No inconsistency has been found between the standard model of elementary particles and experimental data.

In these sentences, "well" is used to modify the verbs "agree" and "predict," and "good" is used to modify the nouns "agreement," "explanation," "prediction," "correspondence," "fit" and "reproduction." These words are being used here to characterize the ability of theories to account for experimental data and the de-

gree of agreement between different theories. The problem with the types of usage demonstrated above is the following: Without presenting a standard with respect to which "well" and "good" are used,[9] the validity of their characterizations simply depend on one's point of view. The meanings of "well" and "good" in the original sentences are completely subjective, and for this reason, the assertions here are essentially meaningless. Extracting a scientifically meaningful interpretation from such statements usually amounts to nothing more than guessing.[10]

In (1), it seems that the intention of the author was to assert that because these measured values agree "well" with the predictions of Eq. (7.7), the quantity $\tilde{\alpha}$ is a very good approximation of the linear thermal expansion coefficient, and he added "well" to "can be regarded" to express this point. There are a number of problems with this. First, as discussed above, this use of "agree well" is essentially meaningless. (Similar discussion is given with regard to (3) and (7) in the previous section.) When encountering this sentence, the reader can only wonder on what basis the author is making this claim. To begin with, it is quite unclear whether this statement is made with regard to a qualitative comparison or a quantitative comparison of the experimental and theoretical results. Then, even if it is assumed that this statement is meant to be with regard to a quantitative comparison, it is not clear if there is some objective measure according to which the agreement is being judged, or if the author simply regards any inconsistencies as tolerably small for some other reason. Because no information is presented to clarify the basis of this statement, the reader can only conclude that it simply expresses the author's opinion, and that it is therefore of very little meaning scientifically.

The second problem with (1) is that the phrase "can well be regarded" is very confusing. It seems that perhaps the author intended to use this as a variant of *could well be regarded*, in which "well" means *easily* or *readily*. (This phrase would not be appropriate in the present case, because "could" expresses an inappropriate hypothetical and volitional meaning.) The source of the problem here is that the construction *can well + [verb]* is generally only used when "can" expresses an *ability*. In the present case, however, it expresses a *possibility*.[11] If we consider this sentence with "can well be regarded" replaced by *can be regarded*, the implication is that *(for the present purposes), it is sufficient to regard $\tilde{\alpha}$ as the linear thermal expansion coefficient.* (Here, "can" expresses the meaning that regarding $\tilde{\alpha}$ as such is allowed or possible in the present situation – that to do so will not cause a problem.) Now, adding "well" strengthens the meaning of "can." However, this strengthening is misplaced. In this case, the resulting meaning is not that $\tilde{\alpha}$ is a very good approximation of the linear expansion coefficient but, rather, that we are very allowed to regard $\tilde{\alpha}$ in this way.

It would appear that the meaning intended by the author is that expressed by one of the rewritten forms. I now discuss each in some detail.

[9] Such standards could be provided by, for example, the precision of the experimental or numerical results under consideration, the discrepancy between experiment and some previous theory, or the precision, accuracy or utility needed for a particular application.

[10] For related discussion, see Chapter 6.

[11] Compare the present example with the (correct) sentence *We can well imagine the result.*

Both (1) and (1*) convey the idea that each of the experimental values is consistent with its corresponding theoretical value and that because of this consistency, $\tilde{\alpha}$ can be regarded as the linear thermal expansion coefficient. These sentences are apparently describing the situation that in the analysis used to obtain the results under consideration, $\tilde{\alpha}$ was indeed treated as the linear thermal expansion coefficient. It is implied that treating $\tilde{\alpha}$ in this manner amounts to an approximation, but because the experimental and theoretical results obtained with this approximation are consistent, this treatment is justified. The logic of this reasoning is more explicit in (1*), where the expression "sufficient precision" means *precision sufficient for the purpose of the present analysis.* The difference between the situations described by (1) and (1*) and that described by (1**) is clear. In the case of (1***), the experimental results are evidently of a statistical nature. In (1****), it is clearly expressed that the purpose of the present investigation is to obtain a qualitative description of the phenomena in question and that for this purpose, employing $\tilde{\alpha}$ as the linear thermal expansion coefficient is sufficient.

Example (2) is problematic for two reasons. First, interpreting its use of "well" literally, this sentence seems to be describing the manner in which the values under consideration are predicted, while judging from the meaning of the sentence as a whole, it appears to be describing these values themselves. Second, with either interpretation, the meaning of this sentence is quite unnatural. This is obvious in the first case. In the second case, the problem is that, because "well" appears before "predicted," it seems to be acting as a synonym of *thoroughly.* We could solve this problem by simply exchanging "well" and "predicted," but the meaning of the resulting sentence would be unclear from a scientific point of view. Three possible interpretations of the original are expressed by (2), (2*) and (2**), which are all quite different in meaning.

Apparently, the statement in (3) regards the qualitative features of these "forms," although this is not entirely clear. If this is the case, then something like (3) would be appropriate. Note that we could not change "similar" to *the same* here, as the arbitrariness inherent in the comparison of qualitative behavior does not match the definiteness expressed by the term *same.* The remaining rewritten forms express other possible interpretations of the original. Note that in (3**), (3***) and (3****) there are clear standards with respect to which the quality of the agreement in question is being judged, namely, the degree of indefiniteness due to experimental uncertainty, the predictions of previous models, and the statistical quantity χ^2_ν.

Example (4) is completely lacking in scientific meaning. Contrastingly, the meanings expressed by the rewritten versions are clear, and the differences between the situations they describe are evident. Although the assertion of (4) is in some sense subjective, it clearly expresses the idea that the results in question possess certain features that have been identified as "important." Note that, in contrast to the situation discussed with regard to (3), the use of "same" here is not problematic. This is because in the present case, rather than describing the nature of qualitative behavior as a whole, here "same" is used with regard to certain features whose existence is (evidently) objectively verifiable. If, rather than that expressed by (4), the intended meaning is of a quantitative nature, then perhaps something like (4*) or (4**) could be used. It should be noted that in a situation like that considered here, it can never

be said that the two sets of results 'coincide'. Sometimes I see this word misused in such situations. The characterization expressed in (4*) is the closest to a state of coincidence that can be claimed here.

Again, the intended meaning of (5) is very unclear. It should be noted that, in addition to the problem with "well," this sentence demonstrates a serious misuse of "explanation." Judging from the use of this word, it appears that the author's intention was to assert that this model represents the 'true' behavior of these observables. In general, when *explanation* and *explain* are used with regard to the relation between a model or theory and some physical phenomenon, the resulting implication is that this model or theory is 'correct' in an ultimate sense. Obviously such an implication is philosophically problematic and inherently non-scientific. In fact, I find such problematic use of *explanation* and *explain* quite often. Usually it is best to replace these with *description* and *describe* or *account* and *account for*. In (5)–(5****), some of the possible interpretations of the original are expressed. Note that, for the reasons discussed above, "consistent" in (5*) cannot be replaced by *agree*. The meaning of (5**) is that most of the experimental results are consistent with their theoretical counterparts.

It appears that the "agreement" referred to in (6) is that between the descriptions provided by some model in the cases that it employs the "phenomenological" and "microscopic" potentials, although this is obscured by the wording. Note that the use of "well" with "agree" in (6*) is not problematic, because here these words are being used in a comparative manner.[12] Also note that (6*) and (6**) express essentially the same meaning.

The situations in (7) and (8) are quite similar to those in (6) and (5), respectively.

There are several problems with (9). First, the meaning of "good correspondence" is very vague. Second, because no standard of adequateness is stated, the characterization "quite adequate to describe" is essentially meaningless. The original implies that this approximation is adequate in some absolute sense, but this is obviously inappropriate. Third, this use of "according" is erroneous. (See Chapter 3 for discussion of this point.) All of these problems are resolved in (9).

Clearly, (10) and (11) are similar to (6) and (8).

As discussed with regard to (4) of the previous section, the use of "reproduction" demonstrated in (11) should be strictly avoided.

Although (12) and (12) would be construed differently, it seems that the meaning of the latter is that actually intended by the author. The import of this rewritten form is that there exists no experimental result which has been shown to contradict the standard model.

129.2.2 Other inappropriate use of *well*

The following illustrate other ways in which *well* is used with inappropriate meaning.

> (13) These states are all well identified with the $^2 8$ representations of the spin-flavor group and are well compared with the DOQ model predictions.

[12] See Chapter 6 for detailed discussion related to this point.

(13) These states are all identified with the ^{28} representations of the spin-flavor group, and /they/their observable features/many of their features/their most important features/their general features/ are consistent with the DOQ model predictions.
(13*) These states can all be identified with the ^{28} representations of the spin-flavor group, and /they/their observable features/many of their features/their most important features/their general features/ are consistent with the DOQ model predictions.
(13**) These states can be identified with the ^{28} representations of the spin-flavor group with great certainty, and /they/their observable features/many of their features/their most important features/their general features/ are consistent with the DOQ model predictions.
(13***) There is conclusive evidence establishing the identification of these states with the ^{28} representations of the spin-flavor group. In addition, /they/their observable features/many of their features/their most important features/their general features/ are consistent with the DOQ model predictions.
(14) Figure 8 shows that all of the curves of the dielectric loss as a function of frequency can well be reduced into a single master curve.
(14) Figure 8 shows that all of the curves of the dielectric loss as a function of frequency can be reduced to a single master curve.
(14*) Figure 8 shows that all of the curves of the dielectric loss as a function of frequency can readily be reduced to a single master curve.
(14**) Figure 8 shows that all of the curves of the dielectric loss as a function of frequency can be approximately reduced to a single master curve.
(14***) Figure 8 shows that all of the curves of the dielectric loss as a function of frequency can, within experimental uncertainty, be reduced to a single master curve.
(15) The peak shape in the frequency domain can well be fitted by a Debeye-type equation. Frequency domain data, therefore, can well be corrected by subtracting the 'C-R peak' by using the Debeye equation.
(15) The peak shape in the frequency domain can be approximately fitted by a Debeye-type equation. Frequency domain data, therefore, can be approximately corrected by subtracting the 'C-R peak' obtained with this equation.
(15*) The peak shape in the frequency domain is fitted sufficiently well by a Debeye-type equation that the frequency domain data can be corrected in a consistent manner by subtracting the 'C-R peak' obtained from this equation.
(16) There are altogether fifty well observed states.
(16) There are altogether fifty states that have been observed.
(16*) There are altogether fifty states that have been conclusively identified as distinct.
(16**) There are altogether fifty states about which a significant sets of data have been obtained.

(16***) There are altogether fifty states whose features have been described in some detail.
(17) This approximation holds well.
(17) This approximation is sufficiently accurate for the present purposes.
(17*) This approximation leads to negligibly small error.
(17**) This approximation yields values that deviate from the actual values by no more than 10%.
(17***) This approximation yields values with the correct orders of magnitude.
(18) In this state, the surface is well deformed.
(18) In this state, the surface is /significantly/greatly/ deformed.
(19) These conditions are well satisfied.
(19) These conditions are satisfied.
(19*) These conditions are satisfied to within the inherent uncertainties.
(19**) These conditions are approximately satisfied.
(19***) For the present purposes, we can consider these conditions to be satisfied.
(20) These results are well consistent.
(20) These results are consistent.
(20*) These results are largely consistent.
(20**) Most of these results are consistent.
(20***) These results possess the same important qualitative features.
(21) These curves coincide well.
(21) These curves coincide.
(21*) These curves are consistent.
(21**) The discrepancy between these curves is everywhere much smaller than $\delta\tau$.
(21***) Our results seem to indicate that the distance between these curves converges uniformly to zero in the limit of vanishing cell size.
(21****) The discrepancy between these curves is /negligible/irrelevant for the present purposes/.
(21*****) The discrepancy between these curves is not statistically significant.
(21******) The reduced χ^2 value for the fit of these curves is 1.1.

The use of "well" with "identified" in (13) is extremely unnatural. The modification imparted by "well" is understood as applying to the *degree* of the identification in question, and as a result, the meaning conveyed is that these states are somehow thoroughly identified or very identified with the $^2 8$ representations. It would seem that the intended meaning is simply that these states are or can be identified with the stated representations. In this case, it would be best to simply delete "well," and (13) or (13*) would be appropriate. Expressions like *clearly identified* and *uniquely identified* are possible, and these would both be natural if such emphasis is appropriate, but in fact, in most situations, *identified* alone would be understood as implying that the identification is both clear and unique. A second possible interpretation of the original is that the author wished for "identified well" to mean something

like *identified with great certainty*. This interpretation is expressed by (13^{**}) and (13^{***}). A third possibility is that the intended meaning is something like the following: *Most of these states are identified...* This, however, is quite far from any natural interpretation of the original. The second use of "well" in this sentence is another example of the type of problems illustrated by (1)–(12). The expression "well compared" here is meaningless at best.

Although (14), like (1), involves a problem with the construction *can well + [verb]*, the actual nature of the problem is quite different in this case. Note that, while in (1) "can" carries a meaning of *possibility*, in (14) it carries a meaning of *ability*. For this reason, this use of "well" is not incorrect. However, because the meaning of "well" here can be interpreted in many ways, this sentence is very ambiguous. It seems that the meaning the author had in mind is that expressed by (14), (14^{*}), (14^{**}) or (14^{***}).[13] Finally, note that "into" is inappropriate here, because a curve does not have an inside.

Both uses of "well" in (15) involve a problem similar to that in (14). Here, in the first sentence, "well" modifies "can," and this results in an ambiguous statement regarding the ability to fit the peak shape. Contrastingly, in (15^{*}), "well" modifies "fitted," and this gives a clear assertion regarding the quality of the fit. The first "approximately" in (15) also modifies "fitted."

The problem in (16) is similar to that in (13). Here, "well observed" seems to express the meaning of *thoroughly observed*, which is obviously inappropriate in this case. The intended assertion is apparently one of those presented in the rewritten versions. The first two of these are actually quite similar.

In general, to state that an approximation, relation, assumption, etc., 'holds' means that it is valid or true. Thus the statement in (17) that the approximation "holds well," which ascribes a degree to the condition of holding, is not possible.

In (18), "well" is ambiguous. It seems that one of the following would be appropriate here: *fully*, *greatly*, *significantly*, *properly*, *sufficiently*.

Examples (19), (20) and (21) are all similar to (17) in that each contains an assertion expressing the degree of some condition (that of satisfaction, consistency and coincidence) that does not exist in degrees.

[13] There are some subtle points regarding verb modification in these sentences. In (14^{*}) and (14^{***}), the adverb "readily" and the adverbial "within experimental uncertainty" modify "can" (like "well" in (14)), and they describe the ability of some treatment to to reduce the curves under consideration to a single "master" curve. Contrastingly, in (14^{**}), "approximately" modifies "reduced," and it describes the nature of the reduction.

Chapter 130

when

The word *when* is overused and often misused as both a conjunction and an adverb by Japanese authors.[1]

130.1 Inappropriate use in reference to cases, examples, etc.

130.1.1 Misused to mean *in the /case/situation/ that*

Although *when* can be used in reference to a case or situation, its primary meaning regards time. For this reason, this type of use can result in ambiguity.[2] In such situations, the more precise *in the case that* or *in the situation that* should be used instead of *when*. The following examples illustrate this point.

> (1) The inset in this figure shows the dependence of the storage capacity α_c on the inhibitory interaction g when $\theta = 0$.
> (1) The inset in this figure shows the dependence of the storage capacity α_c on the inhibitory interaction g in the case that $\theta = 0$.
> (2) These are the forms of the quadrupole and hexadecapole moments of the nucleus when the valence particles are added from the z-axis to $\mu = \cos(\theta)$.
> (2) These are the forms of the quadrupole and hexadecapole moments of the nucleus in the case that the valence particles are added from the z-axis to $\mu = \cos(\theta)$.
> (3) The method of statistical neurodynamics is practically useful because it enables us to describe long-term behavior when a network succeeds in retrieval.
> (3) The method of statistical neurodynamics is practically useful because

[1] Some of the misuses considered in this chapter seem to result from the mistaken use of *when* to express the meaning of 時. In scientific work, in most situations, it is best not to use *when* in this way. For example, when 時 is used as a synonym of 場合, it usually is best translated as *case* or *situation*, and when it is used with a time-like meaning, it is best translated as *time*, *instant*, *interval*, *point*, or some other explicitly time-like expression.

[2] For discussion of a similar problem involving *where*, see Chapter 131.

it enables us to describe long-term behavior in the situation that a network succeeds in retrieval.
(4) The experimental data are analyzed using the phenomenological optical potential when the incident energy per nucleon is less than 100 MeV.
(4) In the case that the incident energy per nucleon is less than 100 MeV, the experimental data are analyzed using the phenomenological optical potential.
(5) The quantity $W(c)$ here represents the width when $\gamma = c$.
(5) The quantity $W(c)$ here represents the width /at/in the case that/ $\gamma = c$.

Before discussing the problems demonstrated above, it is useful to briefly consider the appropriate use of *when* as a synonym of *in the case that* or *in the situation that*.

In order for *when* to naturally express a meaning similar to *in the case that*, it is necessary that a time-like interpretation (something like *at the time that*, *on the occasion that*, *while* or *whenever*) also be possible. The examples below are typical of such situations.

(6) When we apply this theory to the case of large τ, we obtain more interesting behavior.
(7) When describing a juzu in F_n, we often omit redundant information.
(8) They found many complicated vesicular and cylindrical defects that are connected when the system is in the gel phase.
(9) When Λ is larger than a certain value, polymer lipids move to higher curvature regions.
(10) Topological objects of this type exist when the crack surface consists of more than one part.
(11) When the spacing is too large, the system behaves as a fluid.

In each of these sentences, "when" is being used as a synonym of *in the case that*, but (without changing the substance of the sentence) a time-like interpretation also is also feasible. In situations like this, *when* is often preferable, because longer expressions like *in the case that* can result in awkwardness. Some of the above illustrate this point.

Now, note that, in contrast with (6)–(11), in each of the examples (1)–(5), the time-like meaning imparted by "when" results in unnatural or ambiguous sentences. In (1), it seems to be suggested that the inset displays the dependence in question during the time that the relation $\theta = 0$ holds. It appears that (2) is perhaps describing the time dependence of the quadrupole and hexadecapole moments. Strictly interpreted, (3) would lead the reader to believe that the long-term behavior can be described during the time that the network succeeds in retrieval. In (4), the implication is that this type of analysis is carried out during the time that the energy is below 100 MeV. Seemingly, (5) is asserting that $W(c)$ represents the width during the time that $\gamma = c$. In each of these sentences, however, the intended meaning regards a particular *case*, not a time.

130.1.2 Misused to mean *for the case that*

While sometimes *when* can be used in place of *in the case that* or *in the situation that*, it should never be used in place of *for the case that* (and, more generally, any expression in which the preposition *for* appears). Here I consider some such examples.

(12) We construct solutions when $x = 0$.
(12) We construct solutions for the case $x = 0$.
(13) We shall prove the theorem only when n is even.
(13) We shall prove the theorem only for the case that n is even.
(14) In this section, we give an intuitive description of the system when $a < 1$.
(14) In this section, we give an intuitive description of the system for the case $a < 1$.
(15) The data are plotted when the membrane is undulating.
(15) The data are plotted for the case in which the membrane is undulating.
(16) Figure 2 displays the plot of $\Sigma(\rho)$ when the steady phase wave is dominant.
(16) Figure 2 displays the plot of $\Sigma(\rho)$ for the case in which the steady phase wave is dominant.

Note that in each case here, "when" is being used to express the meaning *for the case that*, not *in the case that*.

130.1.3 Misused as a relative adverb

When can be used as a relative adverb in reference to a time, as demonstrated by the following.

(17) The exact year when this was discovered is unknown.

Such use of *when* as a relative adverb[3] is possible only when it expresses a time-like meaning. However, I often find *when* used in this way to express a non-time-like meaning. The following typify such mistakes.

(18) We simulate the situation when a large number of vortices are close to the domain wall.
(18) We simulate the situation in which a large number of vortices are close to the domain wall.
(19) The case when $v \ll c$ is particularly significant.
(19) The case in which $v \ll c$ is particularly significant.
(20) In the case when this can be ignored, the above expression reduces

[3]In this type of usage, *when* is referred to as a 'relative adverb' because it modifies a verb. (Note that in the (17), "when" modifies the verb "was discovered.") However, the relative clause it introduces as a whole acts as an adjective. (In (17), this clause modifies the noun "year.") In this role, *when* acts much like a relative pronoun and can be thought of as referring to the noun that this clause modifies.

to the following:
(20) In the case that this can be ignored, the above expression reduces to the following:
(21) This discontinuous behavior occurs at the point when $\int d\psi F(\psi) = a$.
(21) This discontinuous behavior occurs at the point where $\int d\psi F(\psi) = a$.

In the original sentences here, "when" is used in reference to the words "situation," "case," "case" and "point." However, because these words do not represent times, these uses of "when" are mistaken. In addition to this problem, there is a problem of ambiguity in (18) and (21). Although here "when" was intended to act as a relative adverb, it could be interpreted as a conjunction, introducing an adverbial clause that modifies a verb (in (18) "simulate" and in (21) "occurs"). With this interpretation, these sentences apparently express the following absurd meanings: *We simulate the situation, and we do this at the time that a large number of vortices are close to the domain wall*; *This discontinuous behavior occurs at the point, and it does this at the time that* $\int d\psi F(\psi) = a$.

As an aside, note that I have used "that" instead of "in which" in (20) and "where" instead of "at which" in (21). I did this because "in the case in which" and "at the point at which" are awkward.

130.1.4 Misused to mean *at*

When should never be used as a synonym of *at*, as in the following.

(22) The two functions $f_1(t)$ and $f_2(t)$ are equal when $t = t_c$.
(22) The two functions $f_1(t)$ and $f_2(t)$ are equal at $t = t_c$.
(23) When $x = 0$, the first term diverges.
(23) At $x = 0$, the first term diverges.

130.2 Misused in reference to a point in time

Although in its primary usage, *when* refers to a time, this use is best reserved for cases in which this is a time interval. Reference to a point in time can yield unnatural assertions, as the following demonstrate.

(1) The field was turned off at the time when this effect could first be discerned.
(1) The field was turned off at the time that this effect could first be discerned.
(2) At the instant when the e^+ and e^- collide, the following is observed.
(2) At the instant that the e^+ and e^- collide, the following is observed.
(3) The phase separation begins when $\langle\varphi(t)\rangle$ exceeds 2.
(3) The phase separation begins at the time that $\langle\varphi(t)\rangle$ exceeds 2.

In all of the original sentences there is a mismatch of meaning, because, in general, *when* is naturally interpreted as connoting an extended time interval, while here it is used in reference to points in time.

130.3 Misused to mean *if*

Although *when* can sometimes be used in place of *if*, there are situations in which this should not be done, as demonstrated below.

> (1) When the film is at least 0.1 mm thick, this condition is satisfied, and the method we have described is applicable.
> (2) When the spatial dependence of ψ is sufficiently weak, we can treat the diffusion term as a perturbation.
> (3) When we consider periodic initial conditions, however, there is no such problem.
> (4) When the chemical potential λ is much larger than the critical value, however, these terms cannot be ignored.

In each of these sentences, "when" should be replaced by *if*.

The difference between *when* and *if* demonstrated by the above examples warrants some explanation. In general, a sentence introduced by *if* is understood as an abstract statement of a causal or logical connection, with no implication about whether the situation under consideration is actually realized. Contrastingly, a sentence introduced by *when* is understood as a concrete description of the circumstances that appear together in some actually realized situation. Therefore, if the intention is to make an assertion of a truly hypothetical nature, *if* is more appropriate, whereas if the intention is to describe an actual situation, then *when* is more appropriate. Now, note that it is most natural to regard each of the above examples as consisting of the statement of a premise, whose realization is not presently in question, followed by the statement of the conclusion that necessarily follows from this premise. However, the apparent implication of "when" is inconsistent with this interpretation.

To understand the above discussion more clearly, let us briefly consider (1). This discussion concerns an experiment involving some kind of film. Using "when" here leads the reader to believe that there are several actual cases that we consider and that one of these is that in which the film is thicker than 0.1 mm. This phrasing would be most appropriate, for example, in the situation that we were investigating a number of films of varying thicknesses, and we found through this investigation that the condition in question is satisfied for those films that are thicker than 0.1 mm. Thus, with this interpretation, this sentence would be considered a statement of an empirical finding with regard to specific cases. In this situation, however, it would be more natural to state the following: *We have found that when the film is at least...* By contrast, in the situation that, based on some previous theoretical or experimental results, it has been established as a general rule that the condition of interest is satisfied if the film is at least 0.1 mm thick, and it is our intention to simply state this rule, then *if* should be used. In fact, the second interpretation seems to be the more natural way to understand (1). In this situation, it would be quite fitting for this sentence to be followed by something like the following: *Although in certain situations this condition can be satisfied for somewhat thinner films, verification can be problematic, and thus to insure the validity of our results, we considered only films of thickness greater than 0.1 mm.*

Chapter 131

where

131.1 Introduction

In its primary meaning, *where* refers to a place. The following demonstrates one of its typical uses when expressing such a meaning.

> The town where I lived has grown.

Here, "where" refers to "town."[1] In informal writing and speech, *where* is sometimes used in this way in reference to nouns that do not represent places. In formal writing, however, generally this should be avoided. In this chapter, I treat problems of this type.

131.2 Inappropriate use in reference to things that are not places

131.2.1 Misused in reference to cases, examples, etc.

The most common misuse of *where* in the presently considered role is in reference to the words *case*, *situation* and *example*.[2] The following are typical examples.

> (1) The situation where ϕ converges to 0 is of particular interest.
> (1) The situation in which ϕ converges to 0 is of particular interest.
> (2) We have ignored the case where the support of the initial conditions is not compact.
> (2) We have ignored the case in which the support of the initial conditions is not compact.
> (3) The opposite case, where $\langle\rho\rangle$ is large and $\langle\eta\rangle$ is small, is characterized by a lamellar pattern.

[1] In this type of usage, *where* is referred to as a 'relative adverb', because it modifies a verb. (Note that in the present sentence, "where" modifies the verb "lived.") However, the relative clause it introduces as a whole acts as an adjective. (Here, this clause modifies the noun "town.") In this role, *where* acts much like a relative pronoun and can be thought of as referring to the noun that this clause modifies.

[2] For discussion of a similar problem involving *when*, see Chapter 130.

(3) The opposite case, in which $\langle\rho\rangle$ is large and $\langle\eta\rangle$ is small, is characterized by a lamellar pattern.
(4) We now consider an example where this simple relation does not hold.
(4) We now consider an example /for/in/ which this simple relation does not hold.
(5) This is the ground-state wave function where the sub-systems are strongly coupled.
(5) This is the ground-state wave function for the case in which the sub-systems are strongly coupled.

In (1)–(4), "where" refers to the nouns "situation," "case," "case," and "example," but because these do not represent places, this usage is quite unnatural. The situation in (5) is even more problematic. Here too, as made clear in (5), "where" refers to what would be considered a 'case', but this word does not appear explicitly.

131.2.2 Other typical examples

The following are additional examples in which "where" refers to things that are not places.

(6) The squares represent the results of simulations using the original phase model, where the dynamics are governed by a set of ordinary differential equations.
(6) The squares represent the results of simulations using the original phase model, /whose dynamics/the dynamics of which/ are governed by a set of ordinary differential equations.
(7) This result is qualitatively consistent with the theoretical prediction for confined exciton states, where the separation between 1S and 2S states becomes larger as the nanocrystal size decreases.
(7) This result is qualitatively consistent with the theoretical prediction for confined exciton states, according to which the separation between 1S and 2S states becomes larger as the nanocrystal size decreases.
(8) This point has also been studied with Monte Carlo simulations, where similar defect structures have been observed.
(8) This point has also been studied with Monte Carlo simulations, in which similar defect structures have been observed.
(9) The arrows indicate the glass transition temperatures, where the temperature coefficient changes discontinuously.
(9) The arrows indicate the glass transition temperatures, at which the temperature coefficient changes discontinuously.
(10) There is a type of dynamical transition where the qualitative nature of the dynamics in the amorphous phase changes drastically.
(10) There is a type of dynamical transition /through/at/ which the qualitative nature of the dynamics in the amorphous phase changes drastically.
(11) The evolution described by this curve is due to a crystallization

process where crystalline structure and lamellar structure are formed simultaneously.
(11) The evolution described by this curve is due to a crystallization process in which crystalline structure and lamellar structure are formed simultaneously.
(12) This indicates that there is a disordered state where thermal fluctuations are enhanced by a feedback mechanism.
(12) This indicates that there is a disordered state in which thermal fluctuations are enhanced by a feedback mechanism.
(13) There are several localized undulations, where polymer lipids are also localized.
(13) There are several localized undulations, within which polymer lipids are also localized.
(14) As μ becomes a small negative value, the distances between vesicles become large, where many lamellar membranes lie.
(14) As μ becomes a small negative value, vesicles come to be separated by large distances, with many lamellar membranes lying between.
(15) The membrane is composed of two layers, where lipids with long polymers are contained in each layer.
(15) The membrane is composed of two layers, and each layer contains lipids with long polymers.

In (6)–(14), respectively, "where" refers to the following: "model," "prediction," "simulations," "temperatures," "transition," "process," "state," "undulations" and "distances." In (15), it refers to nothing.

131.3 Misused in reference to mathematical 'places'

While the relative adverb *where* can generally be used in reference to places, problems can arise when these are 'places' in mathematical systems, as in the situations described by the following.

(1) The points (ρ_n, χ_n) $(n = 1, 2, 3 \cdots)$, where these three functions coincide, correspond to the storage capacities.
(1) The points (ρ_n, χ_n) $(n = 1, 2, 3 \cdots)$, at which these three functions coincide, correspond to the storage capacities.
(2) We derive the parameter region where the particle is localized.
(2) We determine the region of parameter values for which the particle is localized.
(3) We thus have $\psi(x) > \langle\psi\rangle$ where $0 < x < 1$.
(3) We thus have $\psi(x) > \langle\psi\rangle$ /in the interval/for x satisfying/ $0 < x < 1$.
(3*) We thus have $\psi(x) > \langle\psi\rangle$ for $x \in (0, 1)$.

Usually, in reference to any word expressing the meaning of a *point*, in the sense of a specific place, it is better to use *at which* than *where*. This is particularly true in mathematical usage, as in (1). There are two reasons for this. First, *where* is used most naturally in reference to positions in real physical space. Second, it carries a

nuance of an extended region.[3] This contrasts with the meaning of the preposition *at*, which in such situations clearly refers to a single point. To make this distinction clear, consider the following two sentences.

> (4) Many defects appear in the vicinity of the inflection point of G, where our method breaks down.
> (4*) Many defects appear in the vicinity of the inflection point of G, at which our method breaks down.

In (4), "where" (fairly) clearly refers to "vicinity," while in (4*) "at which" (very) clearly refers to "inflection point." Of course, this use of *at which* in place of *where* should not be considered a strict rule, and in fact there are many situations in which the latter is better, as demonstrated below.

> (5) At the point p, where these curves cross, this effect is seen most clearly.

Because the use of "where" here does not cause any ambiguity, and because replacing it with *at which* would result in stylistically poor repetition of "at," in this case "where" is preferable.

The implication of (2) seems to be that the particle is located in the parameter region. There is no such problem in (2), because this use of the preposition "for" makes it clear that this statement is not with regard to the position of the particle. Note also that there is a problem with the verb "derive" in the original. If we wished to use this verb, it would be necessary to change "the parameter region" to something like *an expression for the parameter region*, as it is not this parameter region itself that we "derive."

The use of "where" demonstrated in (3) should be strictly avoided.

[3]Hence, *where* is used most naturally in reference to what would be termed a 場所 in Japanese.

Chapter 132

whether or not

When used synonymously with *if*, the terms *whether* and *whether…or not* express nearly the same meaning and can usually be used interchangeably.[1] However, there are two points that should be kept in mind here. Although *whether…or not* is sometimes preferable when a particular emphasis (discussed below) is desired, it is generally better for the sake of conciseness to use *whether* alone. Second, when *whether…or not* is used, its two pieces should never be separated by a great distance, and usually it is best that they not be separated at all.

Let us consider some typical examples demonstrating the misuse of *whether…or not*.[2]

> (1) Because our DOQ scheme apparently works quite well, we wonder whether strongly deformed states can be obtained with the microscopic theory or not.
> (1) Because our DOQ scheme apparently works quite well, we wonder whether strongly deformed states can be obtained with the microscopic theory.
> (2) To determine whether the emergence of complex eigenvalues is a phenomenon peculiar to the s-wave case or not, we must investigate the eigenvalues of other mass configurations.
> (2) To determine whether the emergence of complex eigenvalues is a phenomenon peculiar to the s-wave case, we must investigate the eigenvalues of other mass configurations.
> (3) We wish to determine whether this solution satisfies the above condition or not.
> (3) We wish to determine whether this solution satisfies the above condition.
> (4) It is unknown whether there are any finite-dimensional subspaces in which the relation holds for $R > R^*$ or not.

[1] However, of these two expressions, only *whether…or not* can be used to express the meaning of *even if*, as in the following: *We must treat this case more carefully whether the anisotropy is ignored or not.* In such a case, if "or not" were deleted, the resulting sentence would make no sense.

[2] The problematic usage treated here apparently results from the widespread misunderstanding that … かどうか is necessarily translated as *whether…or not*. In fact, usually this is not the most suitable translation.

(4) It is unknown whether there are any finite-dimensional subspaces in which the relation holds for $R > R^*$.

(5) Whether this theory can somehow be cast in renormalizable form or not is the subject of great debate.

(5) Whether or not this theory can somehow be cast in renormalizable form is the subject of great debate.

(6) In the present case, whether we take the limit before the integration over θ and after the integration over ξ, as in the previous case, or not, there remains a problem of ambiguity.

(6) In the present case, /whether or not/even if/ we take the limit before the integration over θ and after the integration over ξ, as in the previous case, there remains a problem of ambiguity.

(7) In order to evaluate ξ, we first determine whether a given interval contains any eigenvalues of (3.1) or not.

(7) In order to evaluate ξ, we first determine whether or not a given interval contains any eigenvalues of (3.1).

In each of these examples, the fact that "whether" and "or not" are separated by a large distance makes the phrasing very awkward. Also, in (1)–(4), the meaning imparted by "or not" is somewhat unnatural. In general, the inclusion of *or not* emphasizes that there are two sides to the point in question. In the first four examples, such an emphasis is unneeded, and in fact unwanted. The situation is different in (5) and (7), however. In (5), the point is that there are two sides to this debate, and in (7), it seems that there are two ways to proceed with the evaluation of ξ, one in the case that an interval contains such eigenvalues and one in the case that it does not. For this reason, it is best to retain "or not" in each of these. In the case of (6), "or not" must be included, because here "whether...or not" is synonymous with *even if*.

To end this chapter, allow me to give two examples for which the separation of *whether* and *or not* does not cause a problem.

(8) Whether the medium corrections are included or not, this result cannot be trusted.

(9) In the present case, this is true whether we renormalize or not.

Note that in (8), "whether" and "or not" are separated by a fairly large distance. However, because "whether" appears at the beginning of the sentence, and because the meaning imparted by "or not" is absolutely necessary, this sentence is quite natural. In (9) the separation is sufficiently small to avoid awkwardness. Also, here again, the meaning expressed by "or not" is necessary.

Chapter 133

yet

There are two points to be kept in mind regarding use of the adverb *yet* when it acts as a synonym of *at /this/that/ time*, *up to /this/that/ time* or *until /this/that/ time*.[1] First, this word is overused by Japanese authors. In most cases that I find *yet* in the papers that I proofread, it either adds nothing or imparts an undesirable nuance. In such cases, it should simply be deleted. Typically, *yet* can be used correctly in the situation that, despite there being a reason to expect otherwise, some event or activity has not occurred.[2] In such a situation, *yet* is used to emphasize that the present situation is unexpected. When such an emphasis is inappropriate, it should not be used. Second, even in the case that it adds a desired nuance, *yet* should not be placed at the end of a sentence or clause, as this almost always results in awkwardness.

The following examples demonstrate the two points made above.[3]

> (1) The question of the existence of such solutions, however, has not been investigated yet.
> (1) The question of the existence of such solutions, however, has not been investigated.
> (1*) The question of the existence of such solutions, however, has not yet been investigated.
> (2) There are only a very few observed distant galaxy clusters yet.
> (2) There are only a very few observed distant galaxy clusters.
> (2*) There are yet only a very few observed distant galaxy clusters.
> (2**) At this time, there are only a very few observed distant galaxy clusters.
> (3) There is no dynamical theory of this kind for fully connected oscillator networks yet.
> (3) There is no dynamical theory of this kind for fully connected oscillator networks.
> (3*) There is yet no dynamical theory of this kind for fully connected

[1] This word has many meanings, but it is commonly misused only with the presently considered meaning.

[2] See Chapters 10 and 13 for similar discussion concerning *already* and *anymore*.

[3] As these examples evidence, *yet* is not used as frequently as まだ.

oscillator networks.

In each of the original examples, the appearance of “yet” at the end of the sentence creates awkwardness. Below I explain the differences in meaning among the various rewritten versions.

Although (1) and (1*) are nearly equivalent, there is a slight difference in connotation. With “yet” in (1*), it is intimated that this question is being considered a possible subject of future investigation, whereas (1) includes no such meaning. The reason for this difference is that the use of “yet” implies that the present situation (in which this “question” has not yet been investigated) is in some sense unexpected. Thus, in (1*) there is an implication that the question regarding the existence of these solutions is sufficiently important to warrant investigation, while in (1) there is nothing to support such an interpretation. Owing to its use of “yet,” (2*) suggests that people are presently searching for such galaxy clusters, whereas (2) is quite neutral in this regard. Once again, this difference is due to the ‘contrary to expectation’ nuance imparted by “yet.” In the present case, it would seem to imply that the current situation, in which only very few distant galaxy clusters have been observed, is in spite of significant investigation. The phrase “at this time” gives (2**) a nuance very similar to that of (2*). The relation between (3) and (3*) is similar to that between (2) and (2*). While (3*) leads the reader to believe that people are currently working on the construction of such a theory, (3) does not.

Bibliography

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